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MORALS FOR CONSULTING ENGINEERS.

OWING in great measure to the attitude of the ELECTRICAL REVIEW, electrical manufacturers and contractors are not troubled so frequently now as heretofore by specifications drawn solely in the supposed interests of the buyer. Consulting engineers now act usually as if they really understood the fundamental nature of their function, which is to act as an unbiased mediary as between buyer and seller, seeing that the buyer gets that for which he contracted, but ensuring equally that the seller is treated honourably by the buyer. Too often in time past consulting engineers conceived themselves solely as protectors of the poor buyer, whom they surrounded with a laager of prickly clauses and conditions, while they themselves retired into bomb-proof shelters impenetrable to the contractors' cries for mercy and justice, which seemed to buyer and engineer to be the savage roars of malign and crafty creatures out for their blood.

Occasionally even now specifications are issued as if from the right hand of God, but there are not many consulting engineers in good practice who think it shameful to admit even tacitly that they are at least as fallible as eminent personages in other professions and businesses to whom our Lady Justice still presents the blindfold eyes and even balance which Englishmen are said to adore.

If we think of the reasons which guide an engineer in drawing specifications unfairly to the seller we find two which seem radical. The first is that inaccurate conception of the primary function of a consulting engineer, mentioned above; and the second is sheer ignorance. Both reasons need not be operative in any one case, of course; and it would be difficult to say under which buyers have suffered most.

A very interesting clause from a psychological point of view occurs in many specifications at the present day, and, as it is responsible for much unnecessary hardship, it is desirable to draw public attention to the fact in the hope that alleviation may be obtained.

When a consulting engineer is employed, let us suppose, to devise and superintend the electric lighting of a building, he finds that he has to provide for "cutting away and making good."

He wonders whether he will treat this as part of the wiring contract, or whether it should be left to the builder; and, in reasoning out the matter, he considers first of all the effect upon his client. Obviously it is essential that the cutting away and making good shall be done in such a way that the fabric is not damaged, and to ensure this the work should be done by the proper tradesman, who, in this case, is a builder. Very well, specify that the wiring contractor shall employ a builder to do this work, or simply that it shall be done to the satisfaction of the client's architect. But the

client always employs a particular firm of builders, and will not hear of any other touching the building; or perhaps the building is in course of erection, and it would be impolitic to risk the introduction of two builders on the job. Let us then omit "cutting, &c., . . . " from the wiring contract, and, in order that the client shall know all his liabilities, get the builder to give an estimate for the work. This the builder, like a wise man, refuses to do, as he has no data, and the consulting engineer is not sufficiently well acquainted with the commercial side of electrical work to help him. Here is a dilemma, and here is just where the engineer sometimes lets his feet slip from the path of justice. He resorts to violence to shield ignorance which in this case is quite excusable, and he forthwith places the wiring contractor on the rack. Scratch goes the pen, and out on the innocent paper comes a clause declaring that the cutting away and making good shall be done by Mr. So-and-So, the builder in possession, and shall be paid for by the wiring contractor.

That was a clever stroke! Out comes the buyer from the bog of unknown liabilities, but in goes the contractor. Where now is our Lady Justice? Weeping in a corner while the consulting engineer peeps out of the eye-bandage and tilts the scales to the buyer.

It is easily seen how the tendering contractors are placed, and what the builder will do under the circumstances. The tenderer who estimates human nature most highly will get the job, and the builder will act just as anyone of us below the rank of an angel would act if he were a monopolist.

And the sad end of it all is that the buyer, the very man in whose interest this clever way out of a dilemma has been found, has to pay more for the wiring than if the contractor had been permitted to buy in the open market.

Why do you tender? says the outsider. Why, Oh! Outsider, does anybody gamble, and speculate on and off the Exchange, and bet even on human nature?

As an extreme instance of the cost of "attending electricians," as the builder's phrase goes, comes to memory a contract for £300 on which the builder-in-possession charged between £500 and £600 for this work.

One, at least, of the Government departments has an excellent way of dealing with this admittedly difficult point. Cutting, &c., is excluded from the wiring contract, and a builder is employed by the Department, under the supervision of its skilled officials, to prepare for the wiring contractor, and, if necessary, to make good after him. The contractor has to set out the work, and is required to keep the builder going without intermission; but should the same work have to be gone over again, or should the contractor have forgotten or delayed to set out the builder's work, the cost is borne by the contractor.

The conclusion of the whole matter is that the buyer, or the buyer's engineer, has no right to contract for anything and then close the market to the contractor.

When a Leak is not a Leak.

A RECENT issue of one of our contemporaries devoted to the furtherance of the gas industry contained an analysis of the working of 18 well-known municipal gas undertakings for the year 1911-12, which at first sight gave us rather a shock. For it appears that the gas unaccounted for by these concerns — which we presume disappears somewhere between the works and the consumer—averages out at 5·4 per cent. of the total production, or, roughly, 300,000 cb. ft. per mile of main.

Birmingham, the largest undertaking mentioned, managed to lose some 378 million cb. ft. during the year, averaging 445,000 cb. ft. per mile of main, while its small neighbour Smethwick, with even more elusive gas, got rid of 550,000 cb. ft. per mile of main in the same way.

We have, of course, always known that gas people were callous in regard to leakage on the consumer's side of the meter, and that the discovery of gas in electrical street boxes was a matter of painful surprise to them; now we have in black and white a candid declaration that gas to the tune of half a million cb. ft. per mile of main goes astray, disappears—in fact, anything but escapes. The poor central station engineer tied up by Government regulations enjoining that leakage current shall not under any conditions exceed one-thousandth part of the maximum supply current and compelled to provide instruments to record continuously the deficiencies, if any, of his distribution network, may be pardoned for wondering why this laxity is permitted in the case of a huge quantity of poisonous gas disappearing.

For it does not leak—no one would suggest that for a minute. Indeed, another issue of the same journal in referring to the subject assures us that "the attack is quite wrong in assuming that 'loss of gas' in the annual reports means gas which has escaped—it is simply gas not accounted for, in which leakage is only a factor at any time . . . ."

What could be more convincing?

Miners' Electric Safety Lamps.

ON another page we give a description of the "Ceag" lamp which was successful in receiving the chief prize of £600, and also one of its competitors, the "Stach" lamp, which, with seven others, was awarded a prize of £50 each. Both these lamps, it will be noticed, are German inventions; out of the nine successful competitors there were three from Germany, and amongst them one of such excellent merit that, taking a money value, the judges deemed it worth 12 times more than any of the others. From the descriptions of the two lamps in this issue, it will be easily seen why the "Ceag" is the better, and we may assume that the "Stach" lamp is fairly representative of the other lamps which obtained the minor awards. It is a little difficult to understand why British manufacturers have so neglected this really very important piece of mining equipment, as neglected it undoubtedly has been, and even the offer of a £1,000 prize scarcely roused them from their lethargy. Probably now they will wake up when they really understand that a miner's electric safety lamp is not something that might be wanted sometime, but is already being demanded. For instance, in the report of the late Mr. Pickering (H.M. District Inspector of Mines for Yorkshire and Midland District), we read the following:—"The total number of safety lamps in use was 211,356, being an increase of 3,081, as compared with the preceding year. A striking feature of the table is the increase in the number of portable electric lamps from 69 to 922. With my approval the management of two mines introduced this type of lamp into the workings. They give an incomparably better light than the safety lamps, and their general use would have the effect of reducing accidents, especially from falls of roof and from haulage."

Again, in Mr. Walker's (Scotland district) report, we find:—"At three mines electric lamps have been introduced, and, as far as I have heard, have given satisfaction. There is, in my opinion, a great future for such lamps, and I trust one of this description will be devised and adopted which will meet all the conditions it is claimed the Scotch lamp at present does without the danger it possesses of igniting small quantities of fire-damp, owing to its being carried in the miner's cap."

Altogether, we find that in the mines of Great Britain there were 4,298 miners' electric safety lamps in use during 1911, out of a total of 723,924, so that it would seem there is any amount of room for development. We also note that 341,345 of the ordinary oil safety lamps were lighted by electricity.

Turning for a moment to accidents caused by explosions of fire-damp, we find that the use of naked lights caused 17 separate fatal accidents, resulting in 21 deaths, and 119 separate accidents caused injuries to 184 workmen. One fatal accident, causing three deaths, was traced to a safety lamp, while three other accidents with safety lamps caused injuries to four workmen. Another fatal accident, not included in the above, is supposed to have been caused either by a man "striking a match after his safety lamp was extinguished by gas, or by the gauze of the safety lamp

becoming so hot by its burning with a full-sized flame in fire-damp that the outside gas was ignited."

That "familiarity breeds contempt" is well enough known, and as we are all more or less guilty of treating daily occupations as if nothing untoward ever would or could happen, so it is with the miner. He, last of anyone, expects an accident to him, so that one can understand—though not excuse—a little carelessness on his part, for which he is often severely punished. He must be protected against himself, and the best way to do this would be to supply him with an electric safety lamp. We are quite certain that he would gladly accept it on account of the better light—and there can be no doubt of its being a real "safety" lamp, and not one in name only.

The Gas Danger in Train Lighting.

From time to time we have called attention to the danger of train lighting by gas; indeed, this danger has been officially recognised in this country, although, so far, official warnings on the subject do not appear to have led to any tangible result.

Only last month two further accidents happened. One, at Manchester Exchange Station, where the gas reservoirs of a train were being charged, and escaping gas became ignited by a lamp which one of the men carried, resulted in an explosion and injuries to seven men; the other in Toronto, Canada, resulted in a sleeping car and a baggage car being practically destroyed, while the passengers had barely time to make their escape.

There is a startling similarity between the two cases, as the *Toronto Mail* states that the accident at the Union Station was due to the torch carried by a car tester setting fire to the gas tank under the car, presumably because the latter leaked. At any rate, the flames spread so quickly that the 25 occupants of the car fled in their night attire, minus their belongings, which were destroyed with the car, a similar fate befalling an adjoining baggage car.

So many accidents of one kind or another have been reported in connection with gas-lighted trains, and the safe alternative of electric lighting is so ready to hand, that one begins to suspect Government and railway departments of being alike indifferent as regards the safety of both passengers and employés.

Strikes and the Public.

One is inclined to question the wisdom of setting up a Council to inquire into trade disputes so as to prevent strikes, such Council having no compulsory powers. What can it effect? If it secures respect for its conclusions, it may be able to direct the public sympathy in the right line. No strike can really be a success if the general public do not sympathise. The public did not sympathise in last year's railway strike, because they felt that the strikers had deliberately set themselves to inflict all the injury they could on perfectly innocent people. The public usually come to fairly just conclusions, and one thing they do insist on is that privileged workers, such as Government servants, railway and tramway employés, and the staffs of gasworks and electricity works should have special consideration for the public.

No class of the community can raise its status as a class, except by the will of the general community. Hence the fact that the community really determines the success or failure of a strike according as it approves or disapproves of the action of either side. Thus in the strike of 1897 in the engineering trades the men virtually lost very largely because the public saw that the Trade Unions were acting inhumanly towards the unskilled men, especially in the matter of machine-tool attendance. The strict Trade Union attitude was that the smallest automatic tool should of itself absorb the whole time of one skilled tradesman. We have heard workmen claim that a man has a better chance of rising in America; that in Great Britain a man is kept down to his class by those in higher classes. Yet these very men were rigidly keeping down their assumed inferiors to the lower unskilled ranks from which Trade Unionism forbade them to rise. This sort of thing, of course, prevails in all professions and employments. Medical men of no serious knowledge object to the quack, who may be a mere humbug or may be a far better man than his detractors. But he is of the great order of quacks, and there is no distinction made. George Stephenson was an engineer, if we accept Telford's definition of the title, but he could not enter the Institution, simply because he had not been a pupil to a member of it. To-day all the engineering Institutions have among their members many who are proprietors of works, and some of these men have no title to be regarded as engineers; but their draughtsmen would be shut out or granted Associateship by grace, and yet might be engineers in every fibre. This is all akin to the spirit of the recent strikes, which have been instituted by men in good positions at the expense of their equals who have been less fortunate in securing steady work. The general community is so very largely composed of those whose billets are much less permanent and less remunerative than those of tramway or railway men, that these more or less casual workers count heavily in public opinion.

Any strike Council to be of use must really gauge and act upon the general popular opinion. It is to be hoped that strikers have now learned that they cannot outrage public sentiment and secure public sympathy. The public perceived that the recent dock strike, which put so many unionists into starvation, commenced with a demand to prohibit a non-union man from working. He was to be starved. And the public withheld their support, with fatal consequences to the strike.

A Large Russian Contract.

Some particulars have recently appeared in the daily Press regarding an exceptionally interesting scheme which is under consideration in connection with the supply of water to St. Petersburg. The river Neva being the source of supply, the water has to be purified and sterilised before it can be used, and for some years past the municipal Duma has tentatively employed ozone for the process of sterilisation; the results have been so satisfactory that the system is now to be adopted on a very large scale at the Spalernaia waterworks, where no less than 60 million gallons will be dealt with daily. The estimated cost of the installation—which includes buildings, power plant of several thousand kilowatts, ozone generating plant, air driers and coolers, ozonisers and sterilising towers, and the necessary air and water pumps—was about 10 million roubles, and three tenders were submitted by Continental firms in the neighbourhood of that figure. We are pleased to notice, however, that a British tender has been put in, quoting a price some 3 millions lower for the complete installation; so large a difference must necessarily weigh heavily in our favour, in spite of the well-known influences which are notoriously met with in Russian enterprises, and we can hardly imagine that the City Council will sanction the expenditure of the larger sum in the face of the British offer. The latter, of course, emanates from the Ozonair Co., who, without making any fuss, have been quietly developing their system and have carried out a surprisingly large number of permanent installations, one of the most recent being that for the supply of ozonised air to the whole of the Central London Railway tunnels.

The contract under consideration is not only the largest as yet undertaken by the company, but is also the most important of its kind in the world, and we sincerely trust that the British tender will receive fair and impartial treatment at the hands of the municipality of the Russian metropolis.

National Sporting Club Illumination.—A recent installation of Osram drawn-wire lamps has been put in at the new theatre of the National Sporting Club. The main lighting scheme of this hall consists of three large panelled electroliers, 6 ft. in diameter, carrying 16 frosted round-bulb Osram lamps on the perforated corona at the top and 16 clear 50-C.P. Osram lamps in the interior. The panels of the fittings are glazed with rolled obscured plate glass. A most brilliant light is secured, giving a perfect illumination from ceiling to floor.

THE BRITISH ASSOCIATION.—I.

On Wednesday the British Association opened its annual meeting at Dundee—exactly 45 years to the day and hour, as the President pointed out in his address, from the moment when the Association met at Dundee under the presidency of the Duke of Buccleuch. "There were giants on the earth in those days": such men as Francis Galton, John Tyndall, Archibald Geikie, Sir William Thomson, W. J. Macquorn Rankin, J. Clerk Maxwell, Charles Wheatstone, William Crookes, Alfred Russel Wallace, and Sir William Armstrong—to name only a few—were present on that occasion, when the tide of progress in science and engineering was running high, and boundless fields of discovery were open to the genius of research.

Then John Tyndall delivered an Evening Discourse on "Matter and Force": now the keynote of the meeting, struck by the President, Prof. E. A. Schafer, is the problem of the nature, origin and maintenance of Life—life in the scientific sense, which is essentially associated with matter. We are unable in this place to deal at length with Prof. Schäfer's masterly exposition of this fascinating subject; suffice it to say that, while vast progress has been accomplished and remarkable discoveries have been made in connection with the nature and maintenance of life, the man of science appears to be no nearer to a solution of that eternal mystery—the origin of life on this globe. Regarding the evolutionary hypothesis, the President says:—"The origin of life must have been due to the same process, this process being, without exception, continuous, and admitting of no gap at any part of its course." Quite so; the difficulty is found, not in following the course of evolution, but in accounting for its initiation. Various theories are discussed by Prof. Schäfer, but there is no evidence to support any of them, and eventually he passes on with the remark, "*Assuming* the evolution of living matter to have occurred . . . ." and the word we have italicised aptly sums up the position.

On taking the chair of Section A (Mathematics and Physical Science), Prof. H. L. Callendar, L.LD., F.R.S., briefly referred to four distinguished members who had died during the year: George Chrystal, Professor of Mathematics at Edinburgh for more than 30 years, and secretary of the Royal Society of Edinburgh since 1901, author of well-known mathematical works and of the classical article on "Electricity and Magnetism" in the "Encyclopædia Britannica"; John Brown, F.R.S., who will be remembered for his experimental work on the Volta contact effect between metals; William Sutherland, sometime Professor of Physics at Melbourne and author of numerous papers on molecular physics; and Osborne Reynolds, the first Professor of Engineering at Owens College, chiefly famous for his accurate determination of "J" over a large range of temperature and for his last great work on the "Submechanics of the Universe."

The present year has been one of remarkable activity in the world of mathematical and physical science, if we may measure activity by the number and importance of scientific gatherings for the interchange of ideas and the general advancement of science. Prof. Callendar spoke of the vast importance of such gatherings, not only in their effect on the particular societies or industries involved, but also in their promoting "that ever-growing fellowship among men of science, which is one of the surest guarantees of international progress." The facilitation of the interchange of students between different Universities as discussed at the Congress of Universities of the Empire and the peculiar advantages that would thus accrue to students in the higher branches of research were also touched upon; also the work of the recent Optical Convention in revealing the extent of our optical industry and talent, and that of the Radio-Telegraphic Conference in formulating regulations for extending the applications of modern physics to saving life and property at sea.

Observing the impossibility of reviewing in detail the important work of these Congresses and the equal impossibility of giving any connected account of the recent developments in the rapidly-widening field of physics and mathematics in the short time at his disposal, the President proceeded to adopt an "appropriate alternative . . . to select some theory or idea, sufficiently fundamental to be of general interest, and to discuss it in the light of recent experimental evidence." The advantage of taking stock of our fundamental notions in this way and of determining how far they rest on experimental evidence as distinct from developments of some analogy, reasonable enough up to a point but leading into error if pushed too far, cannot be gainsaid, and in proposing to consider in this way some of our fundamental ideas with regard to heat, Prof. Callendar has created a wise precedent.

At the outset, he remarked that the general impression that there was something fundamentally wrong about the old caloric theory had been gained as a result of the method commonly adopted of selecting all the mistakes made in the application of this theory, and contrasting them with the correct deductions made from the kinetic theory. It was his intention to show this fictitious antagonism between the two theories to be without real foundation, that they should rather be regarded as different ways of describing the same phenomena, and that although the kinetic theory might be generally preferable for elementary exposition, the caloric theory would have the advantage of emphasising the importance of fundamental physical conceptions, which are often lost sight of in the kinetic method of treatment.

The experiments of Rumford and Davy, although proving that caloric did not possess in any marked degree the properties of an ordinary ponderable fluid, did not prevent the simple conception of caloric, as a measurable quantity of something, leading, in the hands of Laplace, to correct values for the ratio of specific heats and to the adiabatic equation for gases. In the same way the conception of the electric "fluids" played a very useful part in the description of electrical phenomena long before their actual existence as physical entities had been demonstrated.

Although still misrepresented on the ground that much of his reasoning is expressed in the language of the caloric theory, the work of Sadi Carnot, "Reflections on the Motive Power of Heat," remains the greatest contribution of the caloric theory to thermodynamics.

Carnot set himself to investigate the conditions under which motive power was obtainable from heat, how the efficiency was limited, and whether other agents were preferable to steam. The answer which Carnot found embraces the whole range of science in its ever-widening scope.

By means of the "cycle" which now bears his name, and using only the simplest conceptions of the caloric theory, Carnot evolved the simple but sufficient rule for maximum efficiency:—"In order to realise the maximum effect, it is necessary that, in the process employed, there should not be any direct interchange of heat between bodies at sensibly different temperatures"; and his famous principle, "The motive power of heat is independent of the agents set at work to realise it. Its quantity is fixed solely by the temperatures between which in the limit the transfer of heat takes place."

By considering a cycle of infinitesimal range of temperature Carnot deduced his derived function, which must be the same for all substances at the same temperature.

This function he proceeded to evaluate from the rough data then available for water stuff, alcohol and air. The method used in this evaluation now generally goes by the name of Clapeyron's equation, because Carnot did not give his equation in algebraic form. During this evaluation for air, Carnot obtained an expression for the heat absorbed by a gas in expanding at constant temperature, and its constant ratio to the work of expansion—a remarkable anticipation of Joule's work nearly half a century later.

This prediction has generally been overlooked chiefly on account of the inclusion of the unknown value of $F_1 l$. A few years ago Prof. Callendar himself discovered in a footnote in Carnot's work, the solution to the whole problem, viz., that if temperature be measured on the perfect gas scale, the value of $F_1 l$ on the caloric theory would be the same for all temperatures, and if represented by a numerical constant A in the equation $W = A Q (T - T_o)$ would exactly correspond with the value of the Joule equivalent.

As Prof. Callendar remarked:—"This solution obtained by Carnot from the Caloric Theory, so far from being incon-

sistent with the mechanical theory of heat, is a direct statement of the law of conservation of energy as applied to the Carnot cycle." Perhaps the actual statement by Carnot in 1824 that "motive power (energy) changes its form, but is never annihilated" is the most remarkable evidence that, but for his early death, the equivalence of work and heat would have been discovered and evaluated as a direct outcome of the caloric theory.

The caloric theory would measure heat precisely as we measure a quantity of electricity. The mechanical theory measures heat as energy just in the same way that we measure electrical energy when we buy it in KW.-hours. In fact, we have the following exact analogues if we adopt caloric as our term for quantity of heat on the caloric theory.

Caloric—Quantity of electricity	$= Q$
Temperature—Voltage	$= (T - T_o)$ or $(V - V_o)$
Heat energy—Electrical energy	$= W$.

Then in these two cases we have the equations—

Heat equation	$W = JH = JQ\,(T - T_o)$
Electrical equation	$W = Q\,(V - V_o)$.

The measure of a quantity of caloric is the work done per degree fall.

What Prof. Callendar termed the "re-discovery of caloric" has been attended by the invention of new names, such as the *thermodynamic function* of Rankine, and the *equivalence value of a transformation* in Clausius' formula, all of which, including the more general term "entropy," are mere aliases of the original caloric, since the quotient of heat energy by temperature is caloric.

The value of importing into our modern theory some of the old "material theories" appears in many ways, and, perhaps, it is not too much to hope that "caloric" as a measure of heat may become as useful a conception as the "charge" as a measure of electrification.

Having outlined his scheme for an amalgamation of the two theories of heat, Prof. Callendar spent a short time in a discussion of the question, "What is caloric?" and after dealing with some of the difficulties of the material theory of heat to explain observed phenomena, proceeded to "speculate a little on his own account."

His speculations are best stated in his own words, and will no doubt form food for further speculation on all sides, opening up as they do new fields into which physicists have scarcely yet dared to enter. He said, "I should prefer to regard the molecules of caloric, not as being identical with the corpuscles of negative electricity, but as being neutral doublets formed by the union of positive and negative corpuscles, in much the same way as a molecule of hydrogen is formed by the union of two atoms. . . . . In the symmetry of nature it is almost impossible that the positive corpuscle should not exist, but even if we regard the existence of neutral corpuscles as not yet definitely proved, it is, I think, permissible to assume their existence for purposes of argument, in order to see whether the conception may not be useful in the interpretation of physical phenomena." Adopting this suggestion, the Professor outlined a theory of heat conduction of the "dissociation" type, and threw much light on many of the vexed questions of the relation between matter and energy and the structure of the ether.

After touching upon the question of the "weight" of caloric and upon its "awkward habit of becoming infinite," Prof. Callendar concluded his address by expressing the hope that he had succeeded in conveying the impression that a caloric theory of heat was not so entirely unreasonable in the light of recent experiment as they were sometimes led to imagine.

In the course of a masterly address to the Chemical Section, PROF. A. SENIER, D.Sc., after reviewing the evolution of chemical science, put the question, "Why should we pursue chemistry?" "It is suggested that intellectual discipline is a reason; but, I ask, for what purpose? Will anyone pretend that intellectual discipline without utilitarian object, without the possibility of using it for the betterment of society, is a worthy pursuit? I think not. . . . Research in chemistry, apart from the possibility of applying it to the advantage of humanity, cannot be defended. The mastery of the seemingly unlimited resources of nature which chemistry achieves more and more, and its use to alleviate the misery and add to the happiness of mankind, is the only worthy and effective defence. . . . But, of course, no narrow idea of utility must be aimed at. Practically any chemical inquiry may lead to results of material advantage. Certainly, nothing could be more mischievous than to make a narrow immediate utility the test. . . . On the other hand, it should not be forgotten that, in making use of the manifold advantages derived from the growth of science, humanity, on its part, owes a great debt to scientific inquirers, and ought to feel it a sacred duty to do in return all in its power by support and encouragement to further scientific research."

In connection with the manufacture of explosives, he pointed out that the ability to wage war was becoming more and more dependent on the work of chemists. When the supply of mineral nitrates is exhausted, or even before that event, the requisite nitrogen compounds will have to be provided in some other way, and almost certainly they will be obtained synthetically from the atmospheric gases which even now are becoming a commercial source.

Turning to the present indiscriminate elementary teaching and neglect of research, he said "if this is not good for scholars or students, it is worse for masters or professors. Our professors work 'whole time' at this 'stall-feeding' process, and if they happen to be strong men mentally and physically they may be able when weary with work to devote any overtime to—what I submit is far the more important matter for the State—the advancement of science by research. But this pursuit requires, for its successful prosecution, for resource and initiative to be at their best, that all the faculties should be in readiness in their fullest strength, freedom, and adaptability." In Germany this strain of elementary teaching is more recent, and is only now being felt.

"Sir Walter Raleigh says that every university is bound to help the poor . . . but that does not mean that a university is doing good if it helps those who have no special bent for learned pursuits to acquire with heavy labour and much assistance just so much as may enable them to pass muster; on the contrary, it is doing harm. I would like to invite the attention of all who are seriously interested in the country's welfare to reconsider the present policy in the teaching of chemistry; and this applies also to other sciences. For the advancement of civilisation, for the increased welfare of the race by the technical applications of our science, it is not the indiscriminate teaching of the masses and the multiplication of examinations that is wanted, but the training of the few, of capable investigators." "Our first endeavour should be to secure under present conditions in the present college or works laboratories, or in laboratories to be specially provided, that capable men, of whom we have many, should be able to devote themselves to research without the worry of teaching and examining or of providing the ways and means of livelihood."

In his address to the British Association at Winnipeg, Prof. Sir J. J. Thomson said: "I have had considerable experience with students beginning research in experimental physics, and I have always been struck by the quite remarkable improvement in judgment, independence of thought, and maturity produced by a year's research. Research develops qualities that are apt to atrophy when the student is preparing for examinations, and, quite apart from the addition of new knowledge to our store, is of the greatest importance as a means of education."

"The object and ideal," said Prof. Senier, "is wrong also in our system of technical training. We aim too much at giving elementary instruction to artizans, which, though important in itself, can never take the place of the higher education of leaders or managers of industrial works. This is different in Germany, where, although the training of artizans is by no means neglected, the chief energy is directed to the training and teaching of the smaller class of managers. There is, too, in Germany a far more intimate relation between academic and industrial work, and the leaders in each often interchange posts. In one respect we have an advantage over Germany; it is important that this should be understood. The higher technical instruction across the Rhine has not been undertaken by the Universities, but is carried out in separate institutions. With us the Universities have gradually undertaken, in addition to the older

technical subjects, theology, medicine and law, the various branches of engineering and agriculture, and even commerce. This, it is to be hoped, will be extended, so that the highly-trained technologist may have the advantage of the undoubted humanising influence of the University."

Prof. Archibald Barr, President of Section G (Engineering), dealt with the æsthetic aspect of engineering, holding that the engineer failed in his duty in so far as his works were detrimental to the health, or destructive to the property, of the community, or in so far as they were unnecessarily offensive to any of the senses of those who were compelled to live with them. Municipal authorities would spend large sums on the adornment of the streets with stately buildings, and on the purchase of works of art—yet they would tolerate the presence of unnecessarily ugly and noisy tramcars in those streets, and draw a paltry income from the display of hideous advertisements. The injuries and inconveniencies resulting from engineering activities were due, he considered, in almost all cases to failures rather than to successes; the more completely the engineer achieved the primary end of his work, the less was the damage or injury that could be laid to his charge. The combustion of fuel did little harm to anyone; it was the imperfection of the combustion that was the main cause of injury to the amenities of populous centres. The time was not far distant when the direct burning of bituminous coal in open grates would be looked upon, not only as a source of serious harm, but as a culpably wasteful practice. Present indications pointed to the coming of a time in the near future, when the power and heat required for industrial and domestic purposes would be distributed electrically, in a perfectly inoffensive manner, from large central stations; and even at these stations there would be no pollution of the atmosphere. In his Presidential Address to the Institution of Electrical Engineers in November, 1910, Mr. Ferranti dealt in a most masterly way with this, which was undoubtedly the greatest of the many schemes at present before the engineering profession. That address read like a chapter from a Romance of Utopia, but unlike most of the forecasts that had been presented to us of ideal conditions in a world of the future, the system which Mr. Ferranti sketched out, and advocated with so much knowledge and convincing argument, did not depend for its reasonableness on the postulation of a perfected humanity. It would not only provide vastly improved conditions of life for the community as a whole, but it would satisfy the more selfish aims of the users of power and the makers of machinery, by increasing the economy of production and stimulating the demand for mechanical appliances.

But there were injuries which might be inflicted upon the community other than those to health and physical comfort. Every one had some sense of the beautiful and the comely, and the engineer whose works needlessly offended even the most fastidious taste was acting contrary to the spirit of his profession, at its best. There had been far too great a disregard of æsthetic considerations in the everyday work of engineers. A greater regard for artistic merit in their designs would not necessarily lead to extravagance, but, in many cases, would conduce to economy and efficiency.

There ought to be a closer connection than was usually recognised between the work of the engineer and that of those to whom the title of artist was usually restricted. The separation of the beautiful and the useful was quite a modern vice. A structure of any kind that was intended to serve a useful end should have the beauty of appropriateness for the purpose it was to serve. The attainment of the highest efficiency brought with it the greatest artistic merit.

(*To be continued.*)

Acton Transfer.—Mr. H. S. Schultess-Young, chairman of the local Ratepayers' Association, during whose chairmanship of the U.D.C. the transfer of the Council's electricity undertaking to the Metropolitan Co. was agreed upon, has issued a manifesto protesting against so important a matter as the completion of the agreement between the parties, as reported in the Review last week, being hurried through a vacation meeting, more especially as in view of the long legal vacation nothing could have been done till October 12th.

MINERS' ELECTRIC SAFETY LAMPS.

As announced in our issue of the 23rd ult., the judges appointed by the Home Secretary in the international competition for the best miners' electric safety lamp awarded the first prize of £600 to Mr. Farber, of Dortmund, Germany, for the "Ceag" lamp, which has been placed on the market in this country by the "Ceag" Electric Safety Lamp Co., of 19, St. Dunstan's Hill, London, E.C. Eight other competitors received £50 each, so that we may assume that the latter were equal in merit, but much below that of the "Ceag" lamp.

This lamp, which is shown in fig. 1, was designed at the instance of a German coalowner after one of the worst mining disasters in recent years, and is the outcome, therefore, of practical necessity; the want of such a lamp was felt in Germany, as it has been in our own country, and we

Fig. 1.—The Ceag Safety Lamp.

understand that some 20,000 have been at work in mines on the Continent for some years. It is, therefore, beyond the experimental stage, and in the course of years has been improved since first manufactured until its present state of perfection, sound construction, simplicity, cheapness and, most important of all, safety and reliability, has been attained. The lamp consists of three parts—the accumulator and the "bottom" and "top" parts—and weighs a little over 4 lb. It is so strongly constructed that it may be thrown on to a stone floor without receiving any serious damage, and this experiment was repeatedly made during the practical trials carried out by the judges.

The accumulator consists of a strong celluloid casing and two lead electrodes, the latter being screwed into the lid of the casing. They are circular in shape, which prevents warping, and gives considerable capacity of resistance. The acid is prevented from spilling by a novel arrangement, which permits free escape of the gases. The lid is detachable, and so arranged that the electrodes may be easily changed. Both pole ends are fitted with two detachable contacts on springs, which form the contacts for conveying the current to the glow lamp; this device prevents oxidising troubles, as they may be easily cleaned by washing in warm water. The accumulator is separated from the outer steel casing by an intermediate space, and is thus protected against damage by rough usage or external force.

The bottom part of the lamp is a round, stout corrugated casing of heavily tinned pressed steel, the bottom of which is provided with a small furrow, which keeps the accumulator in position.

The top part of the lamp containing the glow lamp is secured by a bayonet joint to the bottom casing, and is locked by a magnetic lock, which can only be opened by a strong magnet. The connection between the loose contact and the glow lamp is effected through a brass segment which

is insulated from the body of the lamp, and makes it possible to switch the light on and off by simply turning the top part while the lamp is locked. The glow lamp is a metal-filament lamp of 1·5 c.p., and burns after charging—which takes 4-5 hours—continually for a period of 16 hours. The lamp bulb is protected by a thick glass dome in a cage of four iron rods, and is placed between spiral springs, which take up any shock due to a knock or violent vibration, and hence it is not so liable to damage as bulbs rigidly held in position. The chief advantage, however, of this arrangement is that it ensures absolute safety against igniting fire-damp, as should this protecting bulb become broken the electric circuit breaks automatically.

Some of the advantages claimed by the makers of this lamp, as compared with oil lamps, are :—(*a*) It gives a good, well-distributed, steady light approximately twice that of an ordinary safety lamp, burns in any position, does not flicker, and the glass never gets dull or clouded ; (*b*) the bright and steady light makes the miner's work easier, and enables dangerous breaks in the sides or roof to be more easily dis-

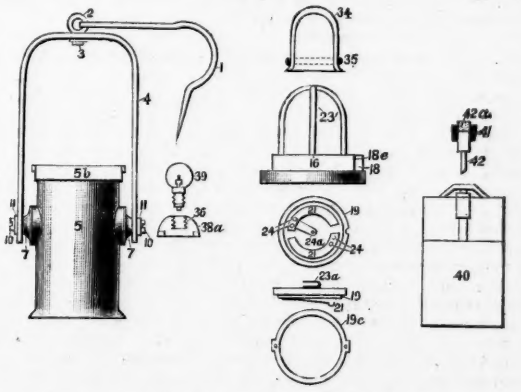
Fig. 2.—The Stach Safety Lamp.

covered ; (*c*) nystagmus and other eye troubles are not so liable to be contracted ; and (*d*) there is absolute safety from ignition of fire-damp.

With regard to the cost of installing these lamps, the makers have not supplied any figures to support their statement, which is to the effect that careful calculations made during several years at a number of mines which are equipped with these lamps show that the cost is not higher than with an oil lamp installation. If the makers can substantiate this statement to colliery owners by practical demonstration, it practically removes the one objection that can be laid against providing miners with electric lamps in place of the uncertain and, we may say, even dangerous so-called "safety" oil lamp. It is, at any rate, satisfactory to note that a modern lamp cabin, to hold 3,000 "Ceag" lamps, is now under construction at Bull Croft Colliery, near Doncaster.

The "Stach" lamp, which obtained a prize of £50, is shown in fig. 2. This lamp is being put on the market by the Electrical Co., Ltd. As will be seen, it consists of a cylindrical wrought-iron welded case, carried on trunnions in a stirrup handle, which is at the top provided with the usual spiked iron hook for the purpose of suspending the lamp by driving the hook into a wood prop during work.

On top of the iron case there is fitted a brass ring, rendered water-tight by means of a rubber seating. The ring and the case are arranged to fit together, and are locked by means of an iron pin worked by a spring, which can only be withdrawn by the use of a powerful magnet, and it is impossible for it to be opened except in the lamp cabin. On the upper part of the lamp is a stout brass wire cage or guard protecting the glass globe and the glow lamp. The former is of considerable thickness, and rests upon a rubber ring, which renders this part of the lamp water-tight and gas-tight. The metal-filament lamp is of the Aegma type, of 2 c.p., 2 volts. It is of the screw pattern, and is specially designed with a view to securing the maximum of safety. It has no tip, but is sealed off so that the bulb is quite smooth. Between the leading-in wires there is placed a little wall of glass, so that even if the lamp were destroyed by breaking the bulb and the filament, the leading-in wires could not be brought together so as to cause a short-circuit and a dangerous spark. The method of lighting the lamp is to turn the upper part in a clockwise direction relatively to the



1, Carrying hook; 2, Eye with rivet; 3, Washer for same; 4, Hoop; 5, Pot; 5b, Fitting ring; 7, Side springs; 10, Side screws; 11, Washers for same; 16, Upper ring; 18, Magnetic lock; 18e, Covering plate for magnetic lock; 19, Drilled ebonite disk; 19c, Bayonet ring; 21. Contact springs; 23, Bent brass rods for guard; 23a, Contact spring for glow lamp; 24, Screws for contact springs; 24a, Lamp contact screw; 34, Patent bell glass; 35, Round rubber fitting ring for same; 36, Lampholder; 38a, Nickel reflector; 39, Patent glow lamp; 40, Accumulator; 41, Rubber plug; 42, Gas outlet cartridge.

Fig. 3.—Stach Lamp, Type R.

lower part. This causes the contact springs to slide over the terminals of the accumulator, thus ensuring a good rubbing contact. Switching off is performed by reversing this operation. There is no perceptible spark at opening or closing the circuit, and lengthy experiments have been carried out which have proved that the ignition of inflammable gas, either inside or outside the lamp, is impossible.

The accumulator consists of a 2-volt, round, semi-dry lead accumulator, in a celluloid case. It is so constructed that it not only always fits down into the proper position in the case, but it cannot be put on the charging board in the reverse direction. This is very simply effected by means of a celluloid projection fixed eccentrically on the bottom of the cell. The electrodes are wrapped in glass wool, which absorbs some two-thirds of the sulphuric acid used as electrolyte, and the plates are so prepared that they are able to stand rapid discharge, and can also be left for many months in a discharged condition without being seriously damaged. In consequence, they may be charged and discharged over 200 times before their useful life is exhausted. A special stopper is provided to prevent the escape of acid, even if the cell be inverted, and to render harmless any gas evolved during discharge, and should any very small drops of acid come through with the gas, they are taken up by a small and easily-replaced piece of absorbent material. The terminals consist of substantial lead blocks properly marked "positive" and "negative," and the celluloid case is hermetically sealed, with the exception of the special stopper above described.

The lamp gives 2 c.p., and after charging will burn for a period of 14 hours. The accumulator should be charged with a current of 1½ amperes for 12 hours.

A concave nickel or aluminium reflector may be provided if desired, so as to project the light in any direction, or to

shield the eyes during use. The lamp is already in use in considerable numbers, and the cost of operation has been proved to compare favourably with that of the ordinary safety lamps.

Its weight, however, when ready for use, is about 6 lb., which is a serious objection, and we would strongly advise the makers to have the weight reduced if this can possibly be done.

AN ELECTRICAL SEWAGE DISPOSAL PLANT.

An article by C. L. Edholm, which appeared recently in the *Canadian Engineer*, describes some American adaptations of the electrolytic process of sewage treatment. Two plants are in operation in the West, and a third, of three times the capacity, is being contructed at a cost of $45,000. These plants may be seen in service at Santa Monica, near Los Angeles, California, and in Oklahoma City, and in the latter town a second plant was ordered after a thorough trial of the one now operating.

The purifying of water by electrolysis has been known for some time, but it was only in late years that experiments were successfully made with the view of destroying the disease germs in sewage and eliminating offensive odour by the use of electrodes.

The process may be described briefly as follows: The raw sewage is allowed to flow through wooden flumes having a length of 30 ft., a width of 22 in. and a depth of 18 in. Ten sets of electrodes are placed in each flume, being composed of cast-iron plates set ½ in. apart and having the dimensions of 9 in. × 24 in. and a thickness of $\frac{3}{16}$ in. These electrodes receive a current of 700 to 800 amperes at 2 to 3 volts, and as the sewage flows slowly through the flumes, it is speedily purified. The odour is instantly "killed," so that there is no offence to the nostrils, even to one standing directly over the flumes. But this is not all; the liquid is clarified as well, and practically all the germs are destroyed, preventing further putrefaction and making it possible to discharge the sewage into a river or upon land for irrigation purposes, without danger to health. This is not a case of the germs being electrocuted, but is due to chemical changes brought about by the decomposition of the metal in the electrodes. Just how this is done has been determined by chemical analysis, but the results are plain to the most casual observer.

The electrical equipment of the Oklahoma City plant consists of a 7½-H.P. alternating-current motor direct connected to a 3-KW. multipolar direct-current generator and exciter, all resting on a single bedplate. The combination delivers to the copper cable conductors 800 to 900 amperes at a voltage of 1½-3, these being the limits between which the desired results are obtainable, varying somewhat with the character of the sewage. A double-pole double-throw knife switch allows the reversal of the current at pleasure, and a knife switch at the upper end of each flume cuts on or off the current for that flume. Owing to the high amperage, as compared to the low voltage, the switches and conductors are necessarily heavy. If only one flume is used, the ammeter is set at 270 or 300.

The Santa Monica plant has, in addition, a centrifugal pump, which is operated by electricity and used for raising the sewage from a reservoir to the level of the flumes, but this is caused by local topographical conditions, as elsewhere it might be convenient to construct the plant on a lower level than the basin.

The cost of current will vary in different cities, but the electrodes need but little (the bill for an entire year at Santa Monica was only $152·95), and the expense of repairs and replacement of plates is slight. One attendant can care for the plant, or even two or three if they are conveniently located for going back and forth between them, as they require hardly any work.

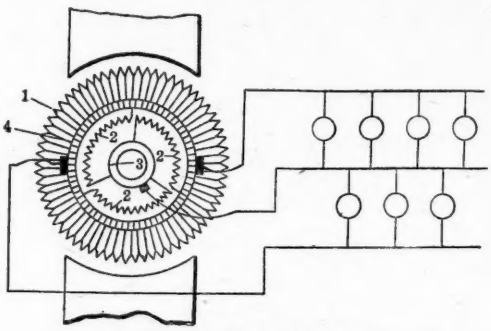
Cleaning of the plates is done by means of reversal of the current, while the use of a garden hose a few minutes each day cleans out the flumes and washes off the plates.

Very limited space is sufficient to house such a plant. In Oklahoma City, a building 18 ft. × 50 ft. and 10½ ft. high encloses a system of three flumes that handles three-quarters of a million gallons a day. In Santa Monica, no ground surface is required, the plant being installed under Colorado Avenue, at the head of the pleasure pier owned by the city. This pier is a popular resort, in spite of the fact that the city's sewage is treated right below it and discharges into the sea at its outer end. Most people are unaware of such a plant being in the vicinity, indicating that it is in no sense a nuisance. To show what it accomplishes, it may be stated that, for a few days, the plant was closed and the raw sewage discharged into the ocean. Protests were heard at once from visitors and residents, but when it started again, all complaints ceased. In Oklahoma, the conditions were quite different, as the outfall was in a dry gulch, which was shunned, and its vicinity rendered useless for any purpose. Now that the discharge has been electrolytically treated, the air is not contaminated. In fact, such water could be used for irrigation, and its great proportion of fertilising content put to good use.

The two plants described can be reproduced for $15,000 each. Many costly features have been eliminated since the first one was installed. The heavy and expensive magnets, once considered necessary, have been discarded, and an elaborate system of cleaning the electrodes by high-pressure steam was abandoned when it was found that the reversal of the current would give better results. The cost of the plates has been greatly reduced by the substitution of cast-iron for the aluminium which was first tried. The aluminium plates gave good results, but they were very costly, and decomposed so rapidly that their expense was prohibitive. The cast-iron was substituted, and by sheathing the upper edge of the plates with copper, excessive decomposition was prevented.

A NEW THREE-WIRE DIRECT-CURRENT GENERATOR.

In a note in the *Electrical World*, Mr. C. L. Pilger, jun., describes a form of three-wire generator now on the market which deserves attention on account of its excellent characteristics as regards efficiency, stability of voltage and simplicity. This machine is similar to the ordinary two-wire generator, except that it has an auxiliary winding so distributed over the face of the armature that the average field in which it moves is always uniform. Any tendency toward flickering is therefore reduced to a minimum. Furthermore, the auxiliary winding forms a circuit in parallel with part of the main winding and generates useful energy all the time,



Double-Winding Three-Wire Generator.

even when the load is balanced. Hence, the overload capacity of such a machine is considerably increased. When balance coils are used there is considerable loss while the machine is in operation, whether the load is balanced or not.

When it is considered that the machine with the auxiliary winding has only one collector ring and no additional apparatus of any kind, its simplicity and efficiency as compared with other systems will readily be understood. The relative arrangement of the armature and auxiliary winding is shown in the accompanying diagram, where 1 is the main winding, 2 the auxiliary winding, 3 the slip-ring, and 4 the commutator. For the sake of simplicity only three windings are shown, but in practice there are usually more.

The voltage of the neutral wire is always the sum of the voltages generated in the coils that are in series between the collector ring and one of the brushes, and this voltage is just one-half the voltage generated by the main winding.

PROCEEDINGS OF INSTITUTIONS.

Electric Cooking.

In the course of a paper read by Mr. Albert Vaux before the Institution of Electrical Engineers (Cape Town Local Section), on June 19th, 1912, the author said, with regard to extended tests in his own household:—

Two years ago we carried out tests with what apparatus was then in town, and taken, so to speak, off the shelves, and our costs, excluding boiling water for washing-up and such-like purposes, worked out at an average of 26s. 3d. per month. Taking the previous 12 months of gas cooking supplemented by all hot water required for such purposes as washing-up or baths, it worked out at an average of 19s. per month exactly; or, in other words, if all oil, gas and outside coal or wood fires had been taken into consideration, I have no doubt the cost would have approached within 2s. or 3s. of electricity.

But even supposing the very worst case, and that electricity is 25 to 30 per cent. dearer than gas, the advantages are so great that it will pay the ordinary householder to install it, apart from any consideration of saving in meat (our own butcher's bill has been reduced quite appreciably since we used nothing but electricity for cooking purposes, and this appreciable saving amounts to 25 per cent.). Coming to more recent tests, we have been using electricity exclusively, with no oil, gas or coal to supplement it—that is to say

all water required for washing-up and kitchen purposes has been boiled on the "Tricity" stove, and our bill is about 26s. per month (at 2½d. per unit).

One ought to add here that all washing and ironing is done at home, and all the ironing is done on a "Tricity" stove. Moreover, all cakes and pastry are baked in the electric oven, and when comparing with the low figures put forward by some people for gas and oil cooking the questions should always be asked—How much cake is bought and how much is paid for ironing (as part of the washing) per month?

This reduction is due partly to the much greater efficiency of the hot plate or disk-stove system, and partly to a reduction in price of electricity from 3d. to 2½d. per unit, as otherwise our bill would have been increased, due to using electricity exclusively.

There is one other point to touch upon, and that is one which appeals to us all—partly to the ladies, because of their servants, and to us (as engineers) for the upkeep, and that is the ease of handling and safety from burning or shock. You may say, "It all seems very nice, and if you are handling it yourself it will be economical, but the moment my servants use it it will go all wrong, and they will leave on the switches, &c." Now, I ask you to examine this apparatus, and say what can a servant do to harm it, except, perhaps, throw a bucket of cold water over it—and even that I should question, although I have not tried it—and let the apparatus get dirty? This is very easily remedied, and it is so easy for the housewife to occasionally supervise and see that everything is kept bright and clean. This is so far as the womenfolk are concerned. I now turn to the menfolk and ask, can anything be more mechanical and a better job than the flexible connections to the stove? Examine the joints of the flexible with the stove, and with the plug, and I think you will agree with me that it is a first-class and thoroughly reliable job.

Finally, please don't think that electrical cooking is for the wealthy or well-to-do only. The cost of operation is within reach of most of us, and it is so simple and cleanly to operate, that nine out of ten ladies will prefer to do their own cooking, or, at any rate, a great part of it—particularly the pastry and fancy cooking—rather than leave it to the servants, and the initial cost can be got over by hiring the apparatus from the Corporation.

Steam Regenerative Accumulators.

By D. B. Morison.

(*Abstract of paper read before the* Institution of Engineers and Shipbuilders in Scotland, *March 19th*, 1912.)

The practical result of the development of exhaust and mixed pressure turbines has been that, on land alone, nearly two million horse-power of electrical energy is being generated by means of exhaust steam which had been previously wasted.

A number of pits are served in the West of Fife district with overhead transmission lines from generating stations situated at Aitken Pit and Mary Pit. The equipment of the latter consists of a 750-KW. mixed-pressure turbo-alternator, the system adopted being three-phase alternating-current at a pressure of 3,000 volts, and a periodicity of 50 cycles. The turbine is of the "Curtis" impulse type, and is supplied with live steam at an absolute pressure of 125 lb. per sq. in. at the turbine stop-valve, the exhaust steam being delivered at a pressure of 16 lb. absolute. This exhaust steam is derived principally from a pair of 38-in. by 72-in. winding engines, making 33 revolutions per wind and about 500 winds in 16 hours. The diameter of the drum is 20 ft., the depth of the shaft 340 fathoms, and about two tons of coal are raised at each wind. The engine makes 33 revolutions per wind. The first six revolutions of the engine, during acceleration, are made on steam at a pressure of 125 lb. per sq. in. absolute without cut-off; the following 18 revolutions, at full speed, are made on one-third cut-off, and the remainder, during retardation, with no steam; therefore, approximately 322 lb. of steam are delivered during the first seven or eight seconds, and 323 lb. during the following 18 seconds, making a total of 645 lb. of steam per wind. This quantity of steam is delivered into the accumulator about 31 times per hour, making an average of 20,000 lb. of steam per hour delivered into this apparatus, which is 9 ft. in diameter by 30 ft. long. The turbine carries a steady average load of about 75 per cent. of the total, and during the winding period the power is derived entirely from exhaust steam. The only exhaust steam supplied to the accumulator, in addition to that supplied by the winding engines, is obtained from a small electric-power engine carrying an average load of about 80 KW. In connection with the regenerative effect of the accumulator, and the use of exhaust steam at the lower ranges of absolute pressure, it is of interest to note that, when the winding engine is not at work, and there is a load of about 100 KW. on the turbine, the exhaust steam from this reciprocating engine maintains the load at an inlet pressure of between 9 and 12 lb. per sq. in. absolute.

Experience has shown that the cost of production, including 12½ per cent. interest and depreciation on the capital outlay for the complete station equipment, has been as low as ·18d. per unit, and rarely exceeds ·2d. per unit.

Fig. 1 is a heat-balance diagram showing the distribution in the various parts of an installation utilising exhaust steam from an intermittently-running reciprocating engine. After deducting the losses, the useful energy generated by the exhaust-steam turbine is equal to that of the reciprocating engine, or a gain of 100 per cent.

Prof. Rateau's original accumulator consisted of a reservoir comprising a series of metal trays containing water, placed vertically above one another, or as an alternative a large quantity of old rails piled together so as to provide space for the free circulation of the steam. This was very costly, by reason of its size and weight. Prof. Rateau then employed water as the heat-absorbing medium and effected the condensation of the steam by passing it through submerged apertures.

An accumulator of this type consists of a cylindrical vessel about half filled with water. Four oval tubes longitudinally disposed in pairs below the water level are perforated on their adjacent sides with rows of small holes. The tubes being connected to the steam supply pipe, the steam on entering passes

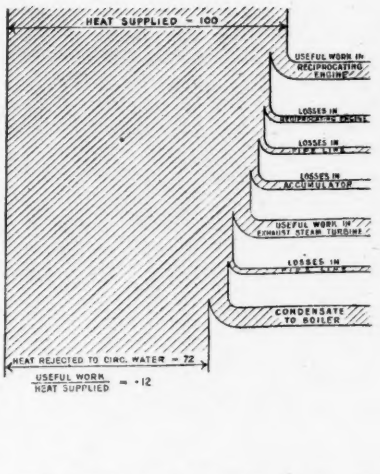

HEAT SUPPLIED = 100
USEFUL WORK IN RECIPROCATING ENGINE
LOSSES IN
LOSSES IN
LOSSES IN ACCUMULATOR
USEFUL WORK IN EXHAUST STEAM TURBINE
LOSSES IN
CONDENSATE TO BOILER
HEAT REJECTED TO CIRC. WATER = 72
USEFUL WORK / HEAT SUPPLIED = ·12

Fig. 1.—Heat Balance Diagram.

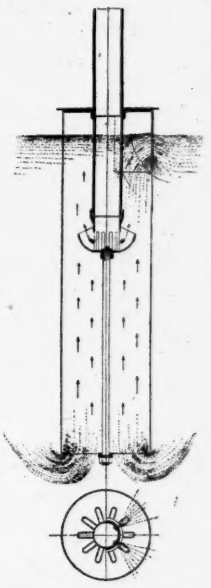


Fig. 2.—Circulating Unit, Rateau-Morison System.

through the holes into the water by which it is entirely or in part condensed, and the issuing streams by causing an active circulation of the water tend to equalise its temperature.

The heat absorbing capacity of this type of accumulator depends on the quantity of water it contains and the temperature range through which it works. As an illustrative example, suppose the safety valve on the accumulator is loaded to 2 lb. above atmospheric pressure, and the exhaust-steam admission valve on the turbine shuts off when the pressure in the accumulator falls to 13 lb. absolute, or 3½ in. of vacuum; then the temperature range is from 218° to 206° F., and the number of heat units which can be theoretically absorbed per ton of contained water is equal to 26,880. This is equivalent to 730 cb. ft. of steam at atmospheric pressure, and on this assumption 1 cb. ft. of water can absorb 19·5 cb. ft. of steam. The action of the apparatus depends on the physical principle according to which a body of water having taken up heat will give off steam when the pressure is reduced.

In the working of a colliery winding engine, the period of acceleration is about one-fifth of the total period, so that during acceleration the amount of exhaust steam may be many times the average and tail off to nothing before the wind is completed. In rolling mill work the effect is similar, but the periods are shorter.

The duration of the stops to be bridged varies for different services, but in the majority of cases may be taken at 60 seconds in colliery work, and from 30 to 45 seconds in rolling-mill work. Exhaust-steam turbines are usually designed for an average admission pressure of 16·5 lb. per sq. in. absolute, and it has hitherto been customary to provide for a pressure range from 18 to 15 lb. per sq. in., or a corresponding temperature range of 10° F. There is, however, no reason why a lower range should not be adopted, and there are a number of plants at work in this country in which the back pressure never rises more than ½ lb. above atmospheric pressure, and in which the pressure in the accumulator drops to 12 lb. per sq. in. absolute, or 5½ in. of vacuum. In such cases it is advisable to fit a self-acting valve in the exhaust main, between the accumulator and the exhaust of the engine, which closes as soon as the flow of exhaust steam stops and prevents a vacuum reaching the reciprocating engine. This is of importance in the case of winding engines, as their regular manipulation is not interfered with, and air leakage into the system is avoided.

The factors which determine the size of a heat accumulator, for any given proposition, depend on the quantity of contained water, its range of temperature, the time available for regeneration, the area of water surface and its efficiency.

Let W = lb. of steam to be regenerated per second; w = lb. of water contained in the accumulator; T = period of regeneration in seconds; L = latent heat per lb. of steam regenerated; t = temperature difference of the water in the accumulator at the beginning and end of regeneration. The latent heat L is nearly constant, and, assuming it to be so, the total heat of steam regenerated above the temperature of the water is W × T × L in B.TH.U., and the quantity of heat energy stored in the accumulator available for regeneration is $w \times t$ B TH.U. Hence W × T × L = $w \times t$, which

determines the size of the accumulator. From this equation it is seen that the capacity is independent of the time of absorption; also that, in order to obtain maximum efficiency, it is necessary for the whole body of contained water to be at a uniform temperature when regeneration commences. Therefore, in order closely to approach this ideal result, a very effective method of circulating the whole mass of water must be adopted. After a very exhaustive series of tests, the arrangement of nozzle placed within a vertical circulation tube, fig. 2, was found to give by far the best results.

In plan the nozzle is in the shape of a star having radial arms, each of which is provided with a narrow slot on its upper surface, through which the steam passes in films, thereby exposing a large surface area to the upwardly-induced streams of water that flow between the arms. It is placed about 9 in. below the water level, and the steam supply is by a tube connected to the main steam supply pipe which is situated in the steam space of the accumulator. The nozzle is fixed centrally within a circulating tube which extends from the bottom of the accumulator up to the water level. There can be no short circuiting of the water with this arrangement, as the entire volume within the effective range of the tube is compelled to travel from the bottom to the top. Having decided what shall be the normal resistance of steam flow through the nozzle, each unit is so proportioned that the kinetic energy of the steam jets is practically wholly absorbed in circulating through the guide tube the greatest volume of water. Circulation by multiple units in the manner described has been proved to be extremely efficient in practice, and the merits of the arrangement are fully recognised by Prof. Rateau. The velocity of the ascending column of water is so quickly established that the difference of temperature between the top and bottom is within 2° F. at the end of a normal period of absorption.

After a period of regeneration, and when the pressure in the steam space of the accumulator is at a minimum, any sudden rush of steam causes undue back pressure on the primary engine by reason of the very high speed of steam through the nozzles, and as the circulating efficiency is at a maximum at the normal pressure for which the nozzles are proportioned, it follows that any excess of pressure is very disadvantageous. But if a by-pass valve is fitted between the discharge pipe from the primary engine and the supply pipe to the turbine, and is loaded at a pressure slightly above that for which the nozzles are designed, then the predetermined back pressure on the primary engine will never be exceeded, and will always be associated with the best conditions for effective circulation. Such a combination of apparatus, by effectually overcoming a difficulty which has often been experienced in practice, greatly enhances the value of accumulators of this type.

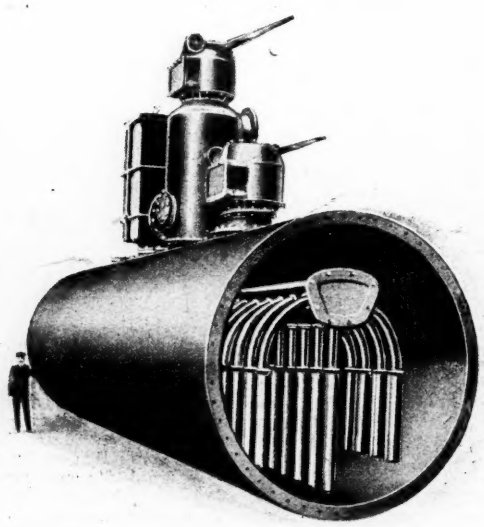


Fig. 3.—Accumulator with End Cover Removed.

In the practical working of accumulators, the presence of oil has been found to have a very degrading effect on efficiency. By far the most serious effect is on the regeneration, as the time lag is so great that the pressure has to fall 1¾ lb., or 60 per cent. of a total range of 3 lb., before the normal regeneration is established. An accumulator with clean water is 100 per cent. more efficient than one in which a film of oil covers the water surface.

A device which is completely successful in overcoming this very serious practical difficulty has been evolved. The top of each circulating tube terminates in a cowl, and as all the cowls discharge longitudinally in the same direction, a surface wave or current is set up which continuously and effectively forces oil, scum, and all floating impurities towards one end into a quiescent collecting chamber, from which they are drained away periodically or continuously as may be desired. The oil is guided into the chamber by plates extending above and below the water line, the entrance being through a port which may be covered by a non-return valve. The cleansing action is continuous and the scumming automatic.

The multiple-unit circulator is also very valuable as an exhaust-steam feed-water heater when the heating steam is delivered intermittently, and the feed reservoir is of considerable capacity. A heater on this system fitted in a forge effected a saving of 10 per cent. in the cost of coal over a year's working.

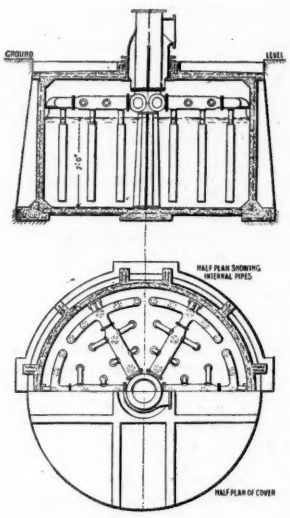


Fig. 4.—Ferro-Concrete Construction of Accumulator.

The great desideratum in a heat accumulator is rapidity of absorption, especially at periods of abnormal supply, so that as much steam as possible is condensed. If, during the period of absorption, the pressure in the steam space in the accumulator is maintained above the pressure corresponding to the temperature of the water, it follows that ebullition will be delayed, and condensation, and, therefore, rapidity of heating will be promoted. This relative increase may be secured by arranging a by-pass connection between the steam supply pipe to the nozzles and the steam supply pipe to the turbine, the connection being provided with a throttle valve which may be automatic, but which can be so adjusted or set as to meet the condition of any particular installation satisfactorily.

It is sometimes convenient to convert old boiler shells into accumulators, but the old boiler proposition is advisable only if the boiler is in good condition, as if it is defective, the natural sequel will be costly repairs, continual annoyance, and ultimate replacement. A construction of accumulator which has the merit of strength and simplicity consists of curvilinear cast-iron sections built together by flanged joints. Cast-iron is less susceptible to corrosion than steel, whilst the requirements of manufacture prevent any undue liberties being taken with the thickness of shell.

A very recent design of accumulator is shown in fig. 4, and consists of a ferro-concrete tank, the steam inlet and outlet being by concentric pipes. The arrangement of interior fittings is very simple, and the entire construction offers considerable possibilities.

In all exhaust-steam plants there are times when the steam supply from the primary engine is greater than can be taken by the turbine and absorbed by the accumulator; under such conditions the surplus escapes either (1) to the atmosphere; (2) is by-passed to the condenser; or (3) may be utilised for feed heating. The first two represent highly wasteful practice; the third alternative results in maximum efficiency.

A regenerative accumulator is under consideration, which will contain 500 tons of water, and will supply a 1,500-kw. turbine for a bridge period of 15 minutes.

Carnegie Hero Fund.—At the monthly meeting of the Carnegie Hero Fund Trustees on August 29th, a case was considered in which David Roberts, labourer (45), in the employment of Messrs. Renton & Fisher, Ltd., steel founders, Bathgate, on July 8th last was killed while going to the assistance of a fellow-workman who had been injured by an electric shock at the works of Messrs. Renton & Fisher. The electric current had set a crane on fire, and made "live" the earth about the same, and in attempting to extinguish the flames by throwing water on the crane, a moulder, named John Drake, received a severe shock and fell on the opposite side of the crane. He was carried aside and artificial respiration was resorted to. Roberts volunteered to assist, and started at once to run across. He was warned to keep clear of the crane, but Roberts in his haste to rescue either did not hear or declined to heed the warning and ran the shortest way, which took him into the danger zone. When passing the crane he touched the handle and fell. He was immediately pulled aside and first aid treatment was applied, but all efforts to restore him failed. Roberts has left a widow and six children. His widow is to receive an interim grant of £10 pending the result of her claim for compensation.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Landlord and Tenant.

In your issue of February 23rd last you replied to an interesting query of a correspondent regarding a tenant's powers as to removal of electric fitments, and as this matter is one which is continually cropping up, there are several other points which would be helpful if they were elucidated.

Lordlords frequently wire their houses and maintain that it is the tenant's part to provide the switches, distribution boards, fittings, &c., and, in cases such as these, would not the tenant be entitled to remove them at the end of his tenancy? Again, where he fixes his own transformer, surely he can remove the same? As a matter of fact, I have generally found they have done so without query.

Regarding the question of ceiling roses, in most houses the greater number of the fittings have metal ceiling plates, which, as they are ornamental, I presume remain the property of the tenant, but as ceiling roses may be part of an ornamental pendant or fitting also, surely the landlord cannot lay claim to even these. If he can do so, why the difference between porcelain and metal ceiling plates?

Generally, if a tenant installs the electric light throughout a house, could any action be taken against him if he—on finding the landlord refuses to pay anything towards it—deliberately cut or damaged the wires on leaving, providing he did not deface the decorations? Would not he be within his rights if he unscrewed the switches, ceiling roses, &c., from off the blocks, on condition that he left the latter to avoid damaging the walls, papers, ceilings, &c.?

It is generally understood that where cupboards, &c., are fixed by means of screws, they remain the tenant's property, but if nailed, the landlord's.

I think you will agree that the matter referred to is one of considerable interest to all contractors, as they are frequently called upon to advise in such cases.

Fixtures.

[Some information on this subject was given by a legal contributor in our last issue. We take it that custom would be the chief guide in deciding the points raised by our correspondent. It is usual for the tenant to remove all his gas brackets, fittings, cookers, &c., when terminating his tenancy, and by analogy he could legally remove his electric lighting fittings, transformer, radiators, cookers, &c.; but, as explained in the reply referred to by our correspondent, switches, ceiling roses, fuseboards and wiring are fixtures, and must not be removed, whether installed by him or not. Nor would he be justified in wilfully damaging any of these items, which as fixtures would have become the property of the landlord.—EDS. E.R.]

Municipal (?) Trading.

In view of the various discussions which occur at intervals, and the sad case in Sheffield, could we draw your attention to the fact that a certain large city has an official who is at present engaged in trying to sell cheap metal-filament lamps on behalf of his department, we presume, as a side line. The individual in question has approached several contractors, and probably consumers as well, stating that he can offer exceptional terms. As the town in question in the past gave a free lamp supply, possibly this statement is correct. Untrammelled as we are at present by professional etiquette, it would be useless to approach this side of the subject; but it might be interesting to know if his Committee have so far fulfilled the law, as to obtain for this gentleman a pedlar's licence.

It seems to us that in neglecting to sell Lipton's sausages and Pink Pills for Pale People, he is obviously neglecting his duty, and we would point out that a larger discount can be obtained off Pocket Flash Lamps, and that this point of view might be placed before the Council.

It seems to us that the E.C.A., or even metal-filament lamp manufacturers, might take some interest in this case, one of the most serious aspects of which is, that it is not done by a small man, but by a responsible official, who pretends to a position of some eminence in his profession, and from whom better things might be expected.

J. E. Schofield.

Bradford, *August 31st*, 1912.

Indirect Lighting.

Further to my letter of June 21st, referring to "Indirect Lighting," I was recently looking over Messrs. Josiah Wedgwood's china showrooms in this town, and was pleased to notice that they are making a china bowl suitable for one or more incandescent lamps. The bowl is of a beautiful design, stamped with their well-known figures. I commend this fitting to the attention of dealers.

Resident Engineer.

Electricity Works, Stoke,
September 2nd, 1912.

Curious Coincidence.

Last Thursday, the 30th inst., during a heavy thunderstorm we had here, there was one very vivid flash of lightning. Coincident with this, the cut-out on the earth indicator of our three-wire system came into action on a 10-ampere earth. Later in the day, three consumers (one private, one business, and one mill), in three different districts of the town, informed us that they could get no light. On investigation, we found that the main fuse in each case, and one sub-fuse in the case of the private consumer, had blown simultaneously with the flash. Can any of your readers explain this phenomenon, as none of the consumers had any outside overhead wiring?

Our middle wire is earthed to the town water supply.

Some little time ago, one consumer complained of his metal-filament lamps breaking during a thunderstorm; is this due to static discharge on the lamps, or to atmospheric vibration?

Junior Assistant.

August 13st, 1912.

Re Contracts in India.

In last week's issue I notice a letter from Mr. Marshall and another. I would like to mention that I have just returned from Bombay, and have for the past three years been in touch with contracts in Bombay, both Government and otherwise. From my experience, I should say there are not more than six firms in Bombay capable of carrying out Government contracts, although there are about a hundred or more electrical contractors who are capable of putting up electric lights and fans, but are not capable, owing to their Indian training in practical work and not having any staff of trained workmen, but only a small office, of carrying out a Government contract.

I have handled several Government contracts in Bombay, but not without being first asked to tender, and on many occasions have missed a contract by a small margin. Probably Mr. Marshall will verify my statements.

W. Bramall.

Birmingham, *August 28th*, 1912.

Insulation v. Earth in Mines.

May I once more raise the point of the relative value of insulation, good insulation, as against earth, good earth, for protection from shock in mines where electrical apparatus are used? I am induced to raise the question once more, from a perusal of your leading article in this week's issue.

For something like 30 years I have been consistently attacking this question of the use of earth. I think it must be nearly 30 years ago that an article from my pen, under the title "What is Earth?" appeared in the technical Press. I have repeatedly pointed out the great difficulty there is in obtaining good earth anywhere; and particularly so in mines at the face. I believe it was in response to urgent suggestions of mine that the late secretary of the Institution of Mining Engineers, who was also secretary of

the North of England Institute, and of the Northumberland Coal Owners' Association, with which the Durham College of Science was at that time closely affiliated, that some very important measurements of the relative resistance of the different strata found in mines, were carried out in the laboratory of the Armstrong College.

About six years ago I read a paper before the Institution of Mining Engineers, at their Manchester autumn meeting, in which I brought out very clearly the great difficulty of the problem involved in obtaining earth at the face in mines, making use of the measurements of the resistance of the different strata that had recently been obtained at Newcastle-on-Tyne.

The ground I take up is, that while insulation can be made certain, absolutely certain, if a sufficient amount is spent on it in the first instance, and if sufficient care is taken in testing the insulating material from time to time; earth at its very best is more or less of an accident. There is no difficulty whatever in obtaining good earth on the surface, or at the pit bottom; but good earth there is a positive danger, if earth is relied upon as a protection, unless there is also good earth at the face, or wherever any apparatus that any man can by any means touch, is placed. My paper read before the Mining Institute pointed out how difficult it was to ensure this good earth; and it also pointed out, what I wish to re-emphasise here, that unless the earth path is of very low resistance, from every apparatus "in-bye" that is connected to earth, right to the main earth on the surface at the generating plant, earth is more than useless, it is a danger. I gather from the report of the recent Committee, that this fact is realised, and is provided for in the requirements that any armour or earth wire or cable must conform to. The new rule in question is undoubtedly a step in the right direction, and a good one, but my point again is, that it is far more difficult to carry out, and far more difficult to ensure that the return earth path shall be of low resistance from every apparatus that may be a source of danger, then to ensure that all such apparatus shall be insulated, and that the insulation shall be maintained at a high standard.

If the cases where men have been killed by electric shock in mines are examined, it will be found that without exception, the cause has been defective insulation. No amount of earthing has protected them; and it is very doubtful indeed whether the greatest care in the provision of earth, and in the maintenance of earth, such care as can be employed in mines, would have protected them. Better insulation in the first instance, more careful and more frequently repeated examination, more frequent tests of the insulation, would have ensured the prevention of nearly every one of the shocks that have led to fatal results.

I need hardly refer to the question of armour. I have repeatedly pointed out, and I believe that there are now a large number of able electrical men who have experience in mines, who agree with me, that armouring is a mistake. It is only in certain cases that the armour really protects the insulation; and in the majority of those cases it could be protected quite as well by non-metallic substances. It is now thoroughly understood, also, that the armour is a danger, unless it is continuous throughout; and anyone who has even a moderate acquaintance with coal mines knows how difficult it is to ensure this. Take the case of a three-phase cable, for instance. It is broken by a fall of roof, and has to be jointed. The joints in the three cables have to be made as far apart as possible to avoid contact between them, and with the materials available for jointing underground, the finished joint is necessarily more or less of a clumsy mass. The difficulty of efficiently jointing the armour across the cable joint proper is almost insuperable under the conditions ruling. It must be remembered that any joint made in iron armour would add considerably to the resistance of the armour as a whole, and that the clumsily made joint described above must add a very large amount indeed, and seriously reduce the protective value of the armour beyond it.

Again, supposing that earth is obtained at the face, where coal-cutting machines are working, where conveyors are working, where gate boxes are fixed; it must be remembered that the coal face is constantly moving; and, again, the difficulty of maintaining good earth connection, is almost insuperable. On the other hand, though the maintenance of the insulation resistance of every insulator at a high value, is not an easy problem; it is by no means an insuperable one; it depends upon the intelligent expenditure of a certain amount of money. Bearing in mind the cost of killing a man, under the Workmen's Compensation Act, the cost of providing good insulation, and of maintaining it, should not be prohibitive.

But, beyond all this, there is an even more serious objection to the use of earth. A case was given in a paper read before the Newcastle Section of the Institution of Electrical Engineers, in which a shock was obtained from the case of a three-phase motor, working near the face, the motor being earthed, and the author of the paper claimed that the shock was due to the earth connection.

Sydney F. Walker.

Bath, *September 2nd*, 1912.

REVIEWS.

Central Station Heating. By Byron T. Gifford. New York: Heating and Ventilating Magazine Co.

This book deals with a class of public service of which we in this country have up to the present had little or no experience. Central station steam and hot-water heating is essentially an American idea, and has been brought to great perfection in that country, where climatic conditions render very thorough methods of warming imperative. In Great Britain and a large part of the European Continent the need does not exist to the same extent; and, further, a conservative attachment to the coal fire has stood in the way of acceptance of the American system except in such situations as public buildings, works and offices. Nevertheless, the book is of interest and value to the British engineer, not only by reason of the information on heating practice it contains, but also because there are unmistakable signs that hot water and steam heating are gaining increased popularity. Whether this will ever lead to the installation of extensive heating stations and mains on American lines is a moot question. There are not wanting experts who maintain that it will, and the mention of the subject by Mr. G. Wilkinson, in his presidential address at the recent I.M.E.A. Convention, is significant and illustrative of the tendency in progressive quarters.

The author deals broadly with the whole subject of heating from central stations by both steam and hot-water systems. He classifies these under four heads: the vacuum steam system, in which there is a low pressure on the steam main and a vacuum on the return main; the pressure steam system, in which there is no return main, the condensed water flowing to the sewers; the open hot-water system, open to the atmosphere at one point and providing for reheating of the return water by mixing with exhaust or live steam; and the closed hot water system, which employs a closed circuit throughout, the return water being reheated by economisers or some other form of heater. The choice of system will depend entirely upon local conditions, and the author deals thoroughly with this important point.

A distinction is very rightly made between systems installed specially for heating, and those in which the heat distribution is merely a by-product scheme. Writing of the latter, he says: "In combining any steam generating plant, such as an electric plant, the financial benefits derived by the primary plant are large. . . . . Where the electric plant is located so that it can serve a good heating territory, it can make a kilowatt of electric energy for considerably less in conjunction with a heating plant than it can by running alone condensing. It is a problem that should be worked out for each situation, but, as a general rule, the revenue from the heat sales will more than pay the coal bills after deducting interest, maintenance and depreciation on the heating investment from the heat income."

There is no exaggeration in this, as a thorough investigation of the subject will prove. There are in America abundant data which show that in a favourable case of a combined electric and heat power house the entire works costs may easily be covered by revenue from the sale of exhaust

steam heat. From the point of view of those interested in the by-product or combined undertaking a fault of the book is that it does not give sufficient detail of what can be and has been done in this direction. There are some 400 central heating stations in the United States, and there is no scarcity of information in that country. A considerable amount was collected and published by the reviewer in the Electrical Review of September 8th, 1911, and a reference to this will show that Mr. Byron T. Gifford is modest in the financial case he makes for well-designed combined electric and heating undertakings.

Of the ten chapters of the book, Chapters II and III are particularly important since they deal respectively with pipe line losses and pipe line design. So much of the success of heat distribution turns upon the pipe line that too much attention cannot be afforded it. The auther appreciates this, and enters very thoroughly into the subject, giving illustrations of both good and bad practice which should be very useful. These two chapters are the best in the book; full of valuable information clearly and concisely expressed. Chapter IV on the subject of rates discusses all the usual methods of charge, and shows that a truly equitable arrangement is by no means an easy one to arrive at. The author has a decided tendency towards rates based upon the maximum demand system. The chapter dealing with the heating station is somewhat disappointing in its brevity. The author states at the outset that only those principles that have to do strictly with central heating will be considered, but the reader who knows little or nothing of the subject would welcome more thorough treatment, particularly if, as in this country, he cannot obtain information on details of lay-out, &c., by the inspection of actual plants. Operation, maintenance and management are more fully dealt with in two chapters, and much sound practical information is given.

Chapter VIII dealing with Franchises is, of course, largely inapplicable to British conditions, but at the same time it should prove of value as indicative of the general lines upon which such matters should be handled. To the American engineer it would certainly be of service, especially as typical franchises are given in full.

There is a good chapter on building equipment, and many figures are given which should be of use and interest to any heating engineer. The effect of the material composing the building, the necessary changes of air, effect of wind and the position of radiators are all dealt with, and it is noticeable that in the latter case the author has his doubts whether the time-honoured "under the window" position is the best for a radiator.

The final chapter of the book is devoted entirely to a collection of miscellaneous data covering 50 pages. It is one of the best of its kind, being both clear and inclusive, but free from the unnecessary matter which often creeps into such compilations.

On the whole, the book is an excellent dissertation on an interesting subject, and can be thoroughly recommended to any engineer who wishes to gain a good insight into both the practical and the commercial aspects of the business. In this country we have not the scope for central heating that America possesses, owing chiefly to climatic conditions, but the fact remains that there are numerous British electricity supply undertakings well situated for such a project, and time will probably show developments in this direction. It is worth the while of most central station engineers to read this book, which, if they have not studied the subject, will put before them possibilities that should not be longer ignored.—F. H. D.

Heat Engines. By H. A. Garratt. London: Edward Arnold. 1912. Price 6s.

The author wrote this book as a sort of review of a favourite subject and with the intention of making his book a not too mathematical exposition of it, and he has succeeded fairly well in his aim. Like many others, he has included the matter of entropy. We can only recollect one good definition of entropy—namely, entropy is an abscissa on a diagram of heat energy, of which the ordinates represent temperature. The ordinary indicator diagram is a diagram of energy, in which ordinates represent pressures and abscissæ represent volumes.

We note, first, that the author uses the pound-Centigrade unit. We do not like this unit. Indeed, we are quite in sympathy with the author in wishing there were but one heat unit; we do not care much if this is the calorie or the B.Th.U., but the mixed unit is bad, and may be put to bad uses. Indeed, it has already been employed to state the calorific capacity of a fancy fuel in such a way as to make this appear as good as best Welsh coal. Especially in statements of tests engineers should make plain the units they employ, even when they are to appear in a public-persuading prospectus.

In his treatment of fuel and combustion, the author is best in the laboratory part, the parts bearing on practice appearing almost as acceptations of statements made in catalogues. But in any case, the space allotted to steam raising would not suffice for any reasonable treatment of the subject, and this section might have been made even shorter, if it could not be much longer.

Chapter IV deals with the properties of steam and gases, with statements of the laws of expansion, of specific heat and explanation of entropy. The author attempts an explanation of the efficiency of the ideal engine, as expressed by the recognised formula, $\frac{T_1 - T_2}{T_1}$, but this explanation is not a happy one, and will not help most students much. It is unfortunate that the academical man can usually afford little help on these difficult points.

But the author is only academical at times; parts of his book are excellent, as when he deals with condensation in pipes, cylinder condensation, engine friction and its relation to continued expansion, steam jackets, superheat, and compounding. We find none of the persistent or wilful errors of the new Manchester school of theorists. And the author is not afraid of saying that the expansion curve of the actual engine is very near to the hyperbola. It is so, but only by accident, but the fact is useful and convenient to work to. The author knows the fact, but is not under any misapprehension about it, and knows that the diagram curve is really a million short lengths of as many other curves, just joined together into an approximate hyperbola.

The author is good, too, on the mechanism of engines, and on valve movement gears, though, perhaps, this is a subject for a separate book. We should like to see a little clearer explanation of hunting where governing is described. The latter part of page 155 is not clear in its language.

Necessarily, the steam turbine is treated somewhat fully, and let us say very clearly, but not on the lines of the engine room. This part remains to be written by some station engineer who has ere this discovered that the quondam simplicity of the turbine has developed into a great complexity of detail, and that a steam turbine is no longer simple either in construction, or to run or maintain, nor is it without its own class of wear and tear.

The remainder of the steam section treats of auxiliary plant in one chapter, and there is considered the internal-combustion engine and gas producers. The Humphrey pump brings this chapter up to date.

There is a closing chapter on the refrigerator or reversed engine which converts work into heat.

This book is an excellent preliminary guide for students and for the practical man who is a student, but it is not an engine-room book.

Studies in Terrestrial Magnetism. By C. Chree, M.A., F.R.S. 1912. London: Macmillan & Co. Price 5s. net.

Magnetism is a branch of physics to which very little attention is devoted in these days of technology and "applied" science. Familiarity with what we are pleased to call the fundamental principles of magnetism has bred in us so great a contempt for this science that we have almost ceased to study it for its own sake, choosing rather to attend to its glorified offspring—electromagnetics.

The study of terrestrial magnetism is now left to about a score of men who, in various observatories scattered over the earth, arrange for the keeping of continuous records of the magnetic elements by means of magnetographs. The maintenance of such records and the proper interpretation of

them is obviously of vast practical importance in navigation, while the study of these continuous magnetograms affords a sure means of advancing the knowledge of the complicated phenomena of terrestrial magnetism.

These "Studies in Terrestrial Magnetism" include most of Dr. Chree's contributions to the subject during his long connection with Kew Observatory. Although the author modestly remarks in his preface that the contributions made by one individual "must form but a small fraction of the whole," it is evident from the scope of this monograph that either Dr. Chree's modesty has betrayed him into unduly undervaluing his own work or his generosity has magnified the work done by his contemporaries. There can be no doubt but that these "Studies" comprise most of the standard work on magnetism, and it is largely to the data collected by Dr. Chree that we have to look for that detailed knowledge of the magnetic elements upon which we may hope to found any general theory, or base our forecasts of the future.

The chief subjects dealt with are Secular Change, Non-Cyclic Change, Diurnal Inequalities, Magnetic Storms and Sunspot Relations.

A special chapter is devoted to the consideration of Arctic and Antarctic disturbances, and this subject is illustrated by curves taken on the Antarctic Expedition of 1901-4 and at four Arctic stations in 1902-3. The special types of disturbances characteristic of the Polar Regions receive full treatment, and are made evident by the curves taken simultaneously in the Arctic and Antarctic Regions and at Kew. To quote the last words of this chapter: "It is to investigations of how the phenomena at different parts of the earth are related, and how they depend on the time of day, on the season of the year, and on sunspot frequency, that we must look as the most hopeful way of advancing knowledge."

On the subject of Sunspots and their Effect on Terrestrial Magnetism Dr. Chree gives numerous tables and valuable data, but is content to wait for still more observations before committing himself to any hypothesis. On the relation between sunspots and magnetic storms, the author is still more reticent, remarking that the solution of some magnetic anomalies may possibly be found in the recognition of different types of sunspots, but advising in the meantime the maintenance of an open mind.

The book has been written with Dr. Chree's characteristic thoroughness and attention to detail, and cannot fail to interest all who would learn something of the magnetic work which is now being done at Kew.—P. H. S. K.

A Short Course in the Testing of Electrical Machinery for Non-Electrical Students. By J. H. Morecroft and F. W. Hehre. London: Constable & Co. Price 6s. net.

In order to make clear the rather special purpose for which this book has been compiled, it may be well to quote the authors' own explanation of their object. "At Columbia University practically all of the engineering students are required to take courses in the electrical laboratories, testing both direct-current and alternating-current machinery. Students in mining, mechanical, metallurgical, chemical, civil engineering, &c., do not have those courses in the theory of electrical machinery which are really necessary for a proper comprehension of the machines with which they work in the laboratory; it is unreasonable to expect them to consult various text-books to prepare themselves in the theory involved in the tests, and it is with the intention of filling the needs of these men that the notes have been compiled."

The term "notes" describes the nature of the contents of the book. They bear strong evidence of being the result of collecting together the instruction sheets used in the laboratory, with some additions to the introductory matter, and of a rather scanty amount of "editing."

It is difficult to criticise the general scheme of the book without at the same time passing judgment on the course of instruction of which we have just quoted the authors' account. It is a question, which we shall not attempt to answer, whether it is wise for "non-electrical" students to spend the very limited amount of time which they have to spare in hurrying through a small number of "tests" embracing such a wide range of machinery, and involving for their just comprehension such a wide field of knowledge as those contained in the book before us. We may say at once that the authors do not attempt to limit the field covered by their experiments to that which is likely to be at all fully understood by their students. The purpose in view seems rather to be to give an opportunity for handling machines of the principal types in commercial use, and not to insist on a comprehension of their principles, except, perhaps, in the case of the continuous-current machines considered in the first part of the book.

The selection of the experiments to be described is well made, and embraces ten experiments on continuous-current generators and motors, illustrating the methods of starting and controlling machines with shunt, series and compound field windings, and of determining their efficiency. A second part deals with properties of the alternating circuit, the alternator, the transformer, the induction motor, the synchronous motor, the rotary converter and polyphase circuits. Particularly in the second part, the introductory text is quite insufficient to give a student any useful idea of the principles involved in the working of the machines which he is instructed to "test." For instance, the whole amount of text devoted to the principles of the induction motor and to the description of the experimental run amounts to five pages. For the ordinary "non-electrical" reader, the book must be regarded as only suitable as a companion to a course of instruction obtained from other sources. It would be quite a mistake to think that any clear idea of alternating-current phenomena or machines is to be obtained from this book alone. As a suggested outline for a very brief course of experimental work, for students who have already gained a fairly sound, though superficial, knowledge of electrical machinery, the book may be recommended.

Proceeding to a more detailed examination, we find the instructions for carrying out the tests to be sound, though they are interspersed with the theoretical portions of the text in a manner which is rather confusing, and which makes a ready reference difficult. It is difficult to find out how much electrical knowledge is assumed on the part of the reader. For instance, the first experiment is a sort of experimental proof of Ohm's law, but the student is expected to use a Wheatstone bridge in the process. In later pages we find some very elementary facts explained in detail, while, at the same time, familiarity with more difficult terms is taken for granted. Certainly, no one without a fair knowledge of the elementary principles of alternating currents could derive any help from the first two pages dealing with that part of the subject, nor could he be expected to understand this introduction to the phenomena of a simple A.C. circuit: "The reactions which are offered to the flow of the current are of two general types—conservative, or non-dissipative, and non-conservative or dissipative. The product of the current into the dissipative reaction gives the rate at which power is being used in the circuit; the conservative reaction causes no energy loss."

In some of the descriptions, it is evident that the instructions are framed with special reference to pieces of apparatus in the authors' own laboratory. It is not always made clear what the nature or purpose of an experiment is to be, before the instructions for carrying it out are given. Finally, the reviewer has to complain of a fault which he has only too often met with in text-books by American writers. The writers seem to be either too hurried, or too careless of such matters, to study the art of writing good English, or even good American.

Laboratory Exercises in Physical Chemistry. By J. N. Pring, D.Sc. Manchester: University Press. Price 4s. net.

This book appears to fulfil a want, as the reviewer is not aware of any other English work covering the same ground. On the whole, the exercises appear to be judiciously selected and calculated to give any student who carries them out in their entirety a fair grounding in the elements of experimental physical chemistry. Considering the title, the omission of any work on optical properties, such as determinations of optical activity and refractive index, and on

emission and absorption spectra, appears curious, and more space might well have been devoted to a description of some type of thermostat and thermo-regulator. The greater portion of the book is devoted to electrochemistry and to pyrometry, and on the whole these portions are well carried out. In the discussion of voltameters on pp. 45 *et seq.*, the time factor is almost ignored, and it is only by very careful reading that a student would gather that the determination and readings given are per unit of time. Here and there the value of the book is marred by great carelessness, as on p. 117, where axoxybenzene is twice referred to as azobenzene (in one case actually underneath the formula). The punctuation is also faulty in places to a degree which materially affects the clearness of the text, and the author's English has a curious German cast, all too common in works of this kind, and suggesting recent residence abroad.

The Development of the Incandescent Lamp. By G. Basil Barham, A.M.I.E.E. London: Scott, Greenwood and Son. Price 5s. net.

To those interested in the manufacture and sale of incandescent electric lamps, there is no doubt that this work will be very useful. The first chapters dealing with early history are almost thrilling, but when one reaches those pages dealing with the tungsten lamp interest begins to flag, owing to the monotonous repetition indulged in by the author. Had the blue pencil been more freely used, we believe that an even better book would have been evolved, for in one or two instances pages are utilised to enlarge upon a process or processes most pithily described in a previous paragraph. Such padding as this reduces the efficiency of the book, and leaves an unfavourable impression. As things are, however, Mr. Barham's work fills a distinct gap, and will be very greatly appreciated.

The manufacture of the carbon lamp and its filament is passed over somewhat cursorily, and little is said of the metalised filament, but the account of the tantalum lamp is treated in a very able manner. Very fully does the author describe the various methods of making tungsten filaments: in fact, the title of the book might well have been "The Development of the Tungsten-Filament Lamp."

On page 85 the following paragraph appears:—"The tungsten filament is not a clean metallic wire as in the tantalum, but it is, in the majority of instances, a filament consisting of minute particles of metal sintered into coherence by the passage of an electric current after it has been squirted and dried." During the last twelve months the "drawn-wire filament" has made such extraordinary strides that the above hardly applies, for the tungsten filament is now a clean metallic wire far surpassing in life the tantalum filament, which rapidly disintegrates.*

After a chapter relating to the osmium lamp, one is allowed a glimpse of the latest developments, chief reference being to the silicon and helion lamps. In this, the last chapter, are also given hints relating to improvements that may be expected. Had the author included a chapter or so of technical and life data, together with some curves, he would have evolved a book that all electrical engineers would desire to have upon their shelves.

Storage Batteries. By H. W. Morse, Ph.D. London: Macmillan & Co. Price 6s. 6d. net.

The chemistry and physics of the lead accumulator form still a subject which demands some share of attention, although the lead cell has long ceased to be a real factor in the problem of prime power sources. The storage cell is a mere assistant to be called on for temporary aid in time of need, either to tide over an ugly peak in the load on the prime source, or to serve as a stand-by when the main source is disabled for a short time, and its aid is often quite invaluable under these conditions. The book before us is by one who *believes* in the primary cell. He candidly admits his belief in the possibility of constructing a primary cell more efficient and more flexible as a prime source than any of our present prime movers, and so we expect him to lose no opportunity of exploiting the claims of cells even at the expense of some of the recognised power sources. But in this we are disappointed; for, instead of allowing his faith to run away with him, Dr. Morse has provided us with an able exposition of the limitations as well as the possibilities of lead cells, and has discussed the industrial applications of the different types of accumulator with commendable honesty.

No attempt has been made to write a text-book of storage battery engineering, but the peculiarities of cells, their physical characteristics, capacities and efficiencies are dealt with very thoroughly.

Sufficient of the elementary theory of cells is given in the early part of the book to render it useful even to that fast-disappearing type—the engineer with no knowledge of chemistry. To his more happily situated brethren the chapter on "Energy Relations" presents the whole thermodynamic theory of cells in a nutshell, together with valuable data concerning the temperature and dilution coefficients, with deductions as to the most efficient conditions for charge and discharge. The reactions at the electrodes are treated with some degree of thoroughness, reference being made to the two most important theories of Le Blanc and Liebenow.

The three chapters on charge and discharge, capacity and internal resistance should be read by everyone who has the care of accumulators. Indeed, we had almost dared to say that they should form part of the general knowledge of every station engineer. It is truly remarkable what profound ignorance on these subjects reigns in the minds of many people who have to do with lead cells. Many men who could define with ease the capacity of a condenser—seldom, if ever, seen in practice—would be nonplussed if asked to estimate the capacity of the cell on their motor-cycle. And how many electrical engineers appreciate the fact that it is possible to obtain a difference of over 100 per cent. in the capacity of a storage battery for a 20° change of temperature?

The formation of plates of the Planté type is explained, as well as the pasted-plate manufacture, and the commercial applications of the two types are discussed. Diseases and troubles are also dealt with in detail. The book, as a whole, cannot be praised too highly. It is well illustrated with photographic reproductions and clearly-executed curves and diagrams, and should prove useful to a large number of students and practical men.—P. K.

* We understand that the book was greatly delayed in the press; when it left the author's hands the drawn-wire lamp was not on the market.—Eds. E.R.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Holophane Reflectors.

We are informed by Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, that eight entirely new patterns of residence Holophane reflectors are now being placed on the market. Some of these patterns are moulded in designs which closely

Fig. 1.—Siemens "Household" Holophane Reflector.

resemble the best quality cut-glass shades, and therefore will be very suitable for fittings of ornate design. We illustrate in fig. 1 one of the new designs.

The company have issued a list which contains all the new patterns now being introduced to the market.

A G.E.C. Electric Toaster.

The General Electric Co., Ltd., have just placed on the market an electric toaster at a greatly reduced price. This toaster is constructed of nickel-plate metal, mounted on a white porcelain base. The heating element is made of a calorite ribbon strip, firmly held in the nickel framework, and mounted on mica seats. There are two doors, fitted with handles, and worked on hinges, which open downwards and outwards, to allow the bread to be

turned or removed. The weight of the bread pressing on the bottom of these hinged wire doors holds it in position tightly against the bars near the heating element. The porcelain base never gets hot, even should the toaster be used continuously for hours, so it would not damage a highly-polished table. The handles fitted to the doors also remain cool. The doors themselves,

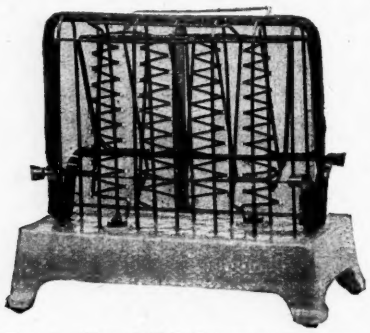


Fig. 2.—New G.E.C. Electric Toaster.

being fairly open, allow the moisture from the toasting bread to escape, and thus the outside of the bread is sure to be crisp. The popular toaster is 8 in. long × 4 in. wide × 7½ in. high, and the power consumption is 500 watts. Sufficient toast can be prepared for an average breakfast in less than 10 minutes.

Stage Arc Lamp.

We illustrate in fig. 3 a special hand-feed economic flooding-type stage arc lamp, supplied by Messrs. Austin Walters & Son, of 57, Lower Mosley Street, Manchester.

The box has been designed to prevent stray light, and at the same time has perfect ventilation; it is constructed of heavy-gauge planished steel, with a thick asbestos lining. The back is entirely enclosed, and all regulating adjustment is made from underneath.

Fig. 3.—Flooding Type Stage Arc Lamp.

The current consumption is only 8 amperes, and a light equal to that of a 16-ampere arc is claimed for it.

Two hand-feed arcs in series are fitted on to one base, and a specially-constructed resistance is built on the stand, together with a D.P. ironclad switch.

New D.C. Motors.

The Electrical Co., Ltd., of 122-124, Charing Cross Road, W.C., have just brought out a series of D.C. machines of new design, embodying the use of auxiliary poles, fan draught, improved brush gear, and the ability to stand 100 per cent. overload without sparking. The accompanying illustration, fig. 4, shows the louvred shutters on the end shields, which provide ventilation, together with

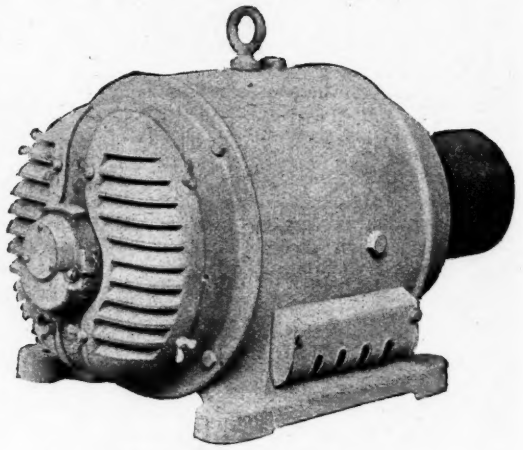


Fig. 4.—New Type D.C. Motor.

protection against the entry of water or other foreign bodies, and the guard over the terminal block. Fig. 5 is a longitudinal section, showing the construction of the machine; the fan is of the radial

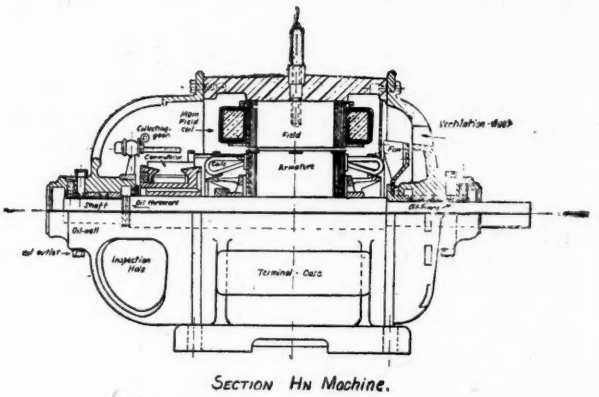


Fig. 5.—Sectional View of New D.C. Motor.

type, to run in either direction, and the air is distributed over the whole of the interior of the machine. The brush gear is ingeniously devised, so that the position of the brushes for either direction of rotation is fixed by the maker, and no mistake can be made. The machines comply fully with the specifications of the Engineering Standards Committee, and the efficiency is maintained at a high figure, at from 50 to 150 per cent. of full load.

B.T.-H. Reflectors.

The British Thomson-Houston Co., Ltd., of Mazda House, 77, Upper Thames Street, E.C., are introducing a variety of Holophane

Fig. 6.—B.T.-H. Holophane Reflector.

reflectors, of which one of novel design is shown in fig. 6, suitable for the lighting of domestic interiors.

SUB-STATION WORKING.

By A. T. BULLEN.

There are few definite laws relating to sub-station practice owing to its dependence on local conditions. The varying demands, the construction, and the situation, each in turn require special consideration, but a little time can be well spent in studying the deficiencies of some sub-stations and those connected with them.

With the heavier machinery and plant installed in sub-stations the writer finds no fault, but he proposes to raise several interesting points and discuss some of the more prominent features of the question of the control of the plant.

Sub-stations can be placed in two primary divisions, viz.: Rotary and Static sub-stations; although it is proposed to refer briefly to the former, attention will be mostly directed to static sub-stations. It is the author's idea in this article to deal with plant that has to be left unattended for lengthy periods, and consequently the rotary sub-station, which always has someone in attendance, will hardly come into the question.

Moreover, those in charge in a rotary sub-station not only should understand the machines and switchgear for which they are responsible, but also the nature of the load which is really the determining factor in the method of procedure in sub-station working. Thus, while for instance, the tripping of an automatic switch in a traction sub-station may mean practically nothing at all, a similar occurrence in a lighting sub-station may spell disaster if not treated in a proper manner. It is true that the ordinary sub-station attendant merely replaces the switch in either case, but in such circumstances the action of the attendant does not add to, or take from, the seriousness or otherwise of the excess current that has been the cause of the tripping of the switch.

However, we shall see that even with the special knowledge they possess, the attendants in a rotary sub-station do not always do the correct thing. The following is an instance :—

Some months ago the writer was in a sub-station in which a single 300-kw. rotary converter was running, when suddenly, without any warning whatsoever, the H.T. switch on the A.C. side came out. The attendant got flurried, stood and looked at it for a few seconds, and then "promptly" proceeded to put the switch in again. Fortunately, the writer was just in time to prevent him, and then he (the attendant) realised for the first time the mistake he had almost made. The difference in volts between the machine and the bus-bars at the precise moment was about 800, while the machine must have been running at something like 200 R.P.M. below its proper speed. The writer wondered why the D.C. switch did not come out, and on examination found that it had been tied in with a piece of cord.

Now, the tying in of the D.C. breaker may, under exceptional circumstances, be quite legitimate, but it is not a thing that should be done indiscriminately. True, machines such as the above are designed to withstand very heavy excess currents for a short period; but when it is necessary to tie in a breaker, it should be released immediately after the overload has fallen off.

Such contingencies as these do not, however, have to be dealt with in a lighting sub-station, in which case the breaker can be set to a definite limit, the exceeding of which means something wrong.

We will now turn to static sub-stations.

As a contrast to the last example, the following is interesting. It occurred in a static sub-station, in which the practice was to leave one transformer only on circuit during the night. As the load went off each evening, so the attendant switched off his transformers one at a time. On this special occasion he was in the act of releasing his first transformer, when, by accident (or carelessness) he tripped the H.T. feeder switch instead of the H.T. transformer switch, which was next to it. Curiously enough, the lighting of the sub-station was taken off that phase, and the place was left in darkness. Instead of acting promptly and immediately replacing the switch he had tripped, the attendant proceeded to meditate after this fashion :—

"Good heavens! What have I done!"

The writer did not wait for him to find out what he had done, but, after restoring the light, very "carefully" explained.

Among sub-station attendants, the craze for experimenting is as prevalent as among many other classes, and often leads to some amusing incidents. The following is a sample :—

Two worthy attendants in a certain static sub-station were one evening discussing the advantages of earthing the whole system on which they were engaged, and proceeded to join up all the outers of the distributors leaving that sub-station (in number about 30), with a piece of copper wire, and were in the act of connecting them to the lead covers of the cables when they were unfortunately disturbed by the mains engineer, who happened to drop in. This gentleman expressed his opinion of them in no uncertain terms. There is a rumour that they have yet to learn the advantages of earthing a system that was never intended for that purpose.

Static sub-stations in outlying districts are sometimes a source of great annoyance, as they are in a great many cases visited but once a day, sometimes less often, and this fact has been responsible for some unfortunate occurrences and awkward positions.

The practice of using automatic switches which have no time lag is, in such cases, open to criticism. The switches installed usually come out quite easily, and, on occasions, much delay and inconvenience has been caused to consumers who depend on the supply for their living.

A few weeks ago an instance of this kind was brought to the notice of the writer. A sub-station which had not a great load on it was one day called upon for a supply for a 40-H.P. motor.

The motor did not start any too well, and just at starting took rather an excessive current, which, however, fell rapidly once the motor had got away, and which, while leaving the L.T. fuses intact, brought out the H.T. automatic switch. The delay caused by this mishap was something like 1½ hours, due to the fact that the men responsible were at the other end of the borough, and could not be immediately located. Had fuses been installed on the H.T. as well as on the L.T. side, or a switch with a time lag, this trouble would have been avoided, for the excess current was of but two or three seconds' duration.

It is the practice in some sub-stations to use H.T. bridge fuses which take the place of a double-pole switch.

These bridge pieces, while claiming the advantage of being quickly replaced in emergency (for spares are always in readiness), are liable to be the cause of curious accidents.

A message was received at the works recently stating that the current was off at one of the consumers' premises.

Investigations showed that it was only too true, and as it was not readily accounted for, a visit was made to the sub-station supplying that particular consumer, when it was found that the fuses had been inserted on the inner of one transformer and on the outer of another. Such an accident as this would have been impossible had proper switches been used. It may be claimed that carelessness was responsible, and not a deficiency in the type of controlling gear, but it must be allowed that the engineer has to contend against such unreliability as this on the part of his assistants.

The question of instruments is interesting, and demands attention. A frequent practice in sub-station working is to have simply an ammeter and a voltmeter fixed (one on each phase, if polyphase), in the station, but the following two incidents will show clearly that these instruments, unless they are of the recording type, are often of little value :—

In the first case the sub-station contained simply one transformer, and was, as a rule, visited only during the day. As the instruments were not of the recording type, the real load on the station was not known to the mains department, and haphazard guesses only could be made. One evening in November the works received a message from the district in which the transformer was installed, stating that the pressure was very low. On examination it was found that the H.T. fuse had blown in the sub-station, and the district, which was purely residential, and consequently gave a

purely night load, was being fed back from another sub-station. The first thing the attendant did was to replace the fuse by a larger one. Not long after the transformer broke down completely through overload. Now, had the instruments been of the recording type, the mains department could not but have noticed that the transformer was being persistently overloaded.

The second instance is of a different nature, but serves also to show the value of recording instruments.

In one of the single transformer (per phase) sub-stations the H.T. fuse failed, but was not noticed by the attendants, although they made a daily inspection. As a consequence, the load was transferred to two other sub-stations in the district; one evening a heavy temporary load came on, which proved too much under the circumstances, but which would have been quite alright had not the two sub-stations been already overburdened by the load of the third. A transformer in one of the two broke down, due to the overload, and the whole of the load being then transferred to the other one, the H.T. fuse there failed, leaving practically the whole of one large district in darkness. The attendants who visited the first sub-station during the day did not have any grave suspicions on finding there was nothing going out from it, but had recording instruments been installed the case would have been quite different.

It will be seen that automatic switches in out-of-the-way sub-stations are often a deal of trouble, and that although ordinary fuses are much preferable, they are, unless handled very carefully, likely to be just as troublesome and cause quite as much inconvenience. It will also be seen that recording instruments should invariably be installed in sub-stations that have not an attendant always in charge; and that one must be most careful in the selection of attendants. There are, of course, many excellent men doing sub-station work, but there are others not so desirable, such as the man who could not imagine what became of the 3,000 "lost" volts in his sub-station, and it is these men one would prefer to see in a different groove.

THE ELECTRICAL WORK AT THE PHYSIKALISCH-TECHNISCHE REICHS-ANSTALT DURING 1911.

By EDWARD S. HODGSON.

The following notes have been compiled from the annual report of the Institution: this report may be found in the "Zeitschrift für Instrumentenkunde," Nos. 4, 5 and 6, 1912.

The usual tests were carried out on machines, instruments, accessories, &c.

At the request of the Commission on Insulating Materials an extensive investigation was commenced on insulating materials with a view to forming a basis for rules concerning the tests of these materials. Sixteen types of insulating materials were supplied by nine firms for the purposes of the experiments. The investigation covered surface resistance, breakdown voltage, change of insulation resistance owing to chemical reactions, exposure to light and weather, liability to combustion under the electric arc, also the behaviour of materials at high temperatures. The results of the investigation have been communicated to the German Society of Electrical Engineers.

In 1909 the Reichsanstalt carried out an investigation into the behaviour of electricity meters on varying loads, both theoretically and experimentally. It was assumed in this investigation that the constant of motor meters is independent of the load. This assumption does not, however, hold in the case of Ferraris meters, and the earlier tests were supplemented in this direction. It was found that in the case of Ferraris meters, fluctuations in load and consequent appreciable differences in the indications of the meters occur only under conditions seldom met with in practice.

A set of decade air-condensers from 0·001 to 0·01 microfarad was constructed, in which the capacity of the connections need not be specially considered. The condensers are comprised of horizontal circular plates: one system being connected to the casing, and the other insulated. The plates were built up in essentially the same manner as in the condensers already mentioned by Giebe (Zeitschr. f. Instrumentenkunde, 29, 1909, pages 269, 301). In the centre of the cover and the bottom of the cylindrical case is a hole; from the hole in the bottom a spring contact pin projects, which is connected with the insulated plate-system. In the inside of the case, under the hole in the lid, is a small contact-plate connected with the same system. When the condensers are placed on each other (the feet acting as a guide), the contact pin of the upper and the contact plate of the lower condenser establish connection between the insulated systems, the other system being connected by the contact with the casing. The set has a baseplate of the shape of the lid of the case, this base having also a hole in the centre, and underneath this an insulated contact plate, from which a wire leads laterally through a tube to the outside. The following sizes were constructed:—0·001 microfarad, 0·001, 0·002, 0·005 microfarad, and a rotary condenser of similar construction of a capacity to 0·002 microfarad.

The 21 standard wire resistances which had been kept in the hygrostat (cupboard for a constant degree of humidity) were only measured once in 1911—viz., on the occasion of the annual comparison in May. It was found that assuming coil 1_D is constant, a small rise took place in all the wire resistances as compared with the values measured in 1910, this rise attaining 0·001 per cent. in the two 100,000-ohm coils, but being of less magnitude in all the other coils. Since the 0·1, 0·01 and 0·001 ohm resistances which were not kept in the hygrostat showed a slight increase by about the same amount (mean, about 0·0005 per cent.), it may be assumed that a considerable part of the changes observed is not attributable to the individual coils, but to a slight decrease of the resistance value of the standard 1_D.

A brief description, with illustrations, is given of a new machine constructed by Hans Boas, of Berlin, for calibrating alternating-current meters.

The differences between the comparisons made at the National Physical Laboratory, the Bureau of Standards (Washington), and the Reichsanstalt, and the methods used in these various institutions for determining the watt-loss in dynamo sheets have in the main been explained. They are chiefly attributable to the fact—which only came to light afterwards—that the strips sent from the National Physical Laboratory to the Reichsanstalt for measurement were all cut parallel to the direction of rolling, and not, as is the recognised practice in Germany, half parallel and half perpendicular to the direction of rolling. The differences left after taking this factor into account lie within the limits of error of observation.

An investigation has been undertaken on the influence of the chemical composition and heat-treatment on the magnetic and electric properties of iron alloys. A report on these tests has been sent to the firms concerned, but the results will not be published until later.

In accordance with the steady displacement of carbon-filament lamps by those having metal filaments, the number of the former tested for life has considerably decreased. For the tests on metal-filament lamps alternating current was generally prescribed.

Special mention is made of a series of four 400 (Hefner) candle, 110-volt lamps, which initially consumed 0·85 watt per Hefner candle, and, after burning for 1,000 hours, consumed 0·92 watt per Hefner candle perpendicular to the axis of the lamp. Under these conditions the C.P. fell by only about 8 per cent. after running 1,000 hours. Further mention is made of a series of five metal filament lamps (11·2 volts 70 Hefner candles) for series use. These lamps remained nearly constant up to 1,500 hours. Of course the manufacture of tungsten lamps has progressed a great step in that it is now possible to manufacture drawn filaments for the lamps, the consequence being increased cheapness and greater resistance to shocks. It is also possible by employing the drawing process to produce thinner filaments of good durability, so that in Germany both 220-volt 16-C.P. and 110-volt 10-C.P. lamps are now on the market. A large number (72) of these lamps were tested for life.

The Reichsanstalt was represented at the International Photometrical Commission, at Zurich, July, 1911. The ratios of the three standard lamps in general use have undergone a change since the last conference, in that the National Physical Laboratory has fixed the standard value for atmospheric humidity for the 10-C.P. Vernon Harcourt lamp at 10 instead of 8 litres per 1 cubic metre of air. The Commission accordingly accepted the following conversion values :—

1 Carcel = $10{\cdot}7_5$ Hefner candle ;
1 Harcourt = $11{\cdot}1_0$ Hefner candle ;
1 Harcourt = $1{\cdot}03_5$ Carcel.

The Reichsanstalt has recently been invited to take part in the movement promoted by the Illuminating Engineering Society (New York) for the introduction of uniform values and designations in photometry.

Some additional researches, &c., which may be mentioned are the following :—An investigation into the eddy current brake and the electromagnetic rail brake ; potential drop in three-phase generators ; the absolute determination of the ohm ; the thermal expansion of marble (carried out in connection with the last-mentioned research) ; measurements of high-frequency currents ; electrometrical measurements on high-frequency circuits ; electrolytic valvular action ; electrolysis of glass, &c.

In all, 49 official and private papers were published by the members of the staff during the year, and a detailed list of these is given at the end of the report.

BUSINESS NOTES.

Consular Notes.—Argentina.—The American Consul at Buenos Ayres, in a recent report, points out that the tramway statistics of that city during the last few years, gave evidence of the efficiency of the service. There has been an enormous development of the city traffic, a development which is surprising, not only when compared with that of other cities, but also when the position now is compared with the position in Buenos Ayres a few years ago. In 1873, when the greatness of the city began to be realised, the tramways carried 13,156,350 passengers : 10 years later (in the period of the horse cars) the total number of passengers was augmented to 17,965,437 ; a decade later, due to the increased population of the city, 57,799,362 passengers were carried. With the change from horse cars to electric cars came a great improvement and extension of the system in all directions, and the number of passengers carried multiplied beyond the most sanguine expectations. During the year of 1911, just past, 355,531,182 passengers made use of the facilities offered, the companies receiving $14,969,446 (United States gold) in fares.

Corea.—The American Consul at Seoul reports the announcement by the Seoul Press that the Japanese firm of Okura & Co., of Tokio, has made arrangements under Government permission for installing on the Chongchon River an electric plant to supply the demands of the mining district of North Pyongan Province. The scheme contemplates the supply of motive-power, tramway service, and lighting, and contracts have been already entered into with the Oriental Consolidated Mining Co., the Chosen Mining Co. (both American), and others for the supply of over 2,000 H.P. The Consul is informed by representatives of these companies that this arrangement is considered of great advantage, in view of increased cost and growing scarcity of wood for fuel. The coal to be used in the work will be supplied from Manchuria, where Okura & Co. control the output of the Penshu Colliery. The machinery required will be obtained from Germany. Okura & Co. are the sole agents for Japan of the A.E.G. of Berlin.

Canada.—The American Consul at Fredericton, New Brunswick, reports that the hydroelectric station which is to utilise the power of the Eel River and its tributaries in Cartleton County, is to be constructed in a short time. When completed, the station will be in a position to supply cheap power to all the neighbouring towns, including Fredericton. Letters of incorporation were secured in 1911. A company, capitalised at $98,000, is applying for letters of incorporation to do business under the name of the Welsford and Hamstead Telephone Co. It proposes to carry on a general telephone business in Queen's County, with a head office in Welsford.

China.—The American Consul at Shanghai, reporting recently on general conditions in China, writes as follows :—"China is at the dawn of an era of industrial development, and the demand for implements for this expansion should continue to increase for many years to come. The following are ideas and views gleaned from local representatives for machinery and electrical appliances from time to time. The British and German firms are obtaining more business than their competitors because they study the requirements of the market more carefully than manufacturers of other countries and have far superior organisations in China. They also grant special terms of payment which Americans are not often willing to give. This is particularly true of the Germans, in whose country the banks amalgamate with manufacturers' syndicates, with the result that any scheme presenting a reasonable prospect of success is financed through this combination and German capital purchases the German materials with which the plant is fitted. There is usually a first partial payment and a lien taken on the plant so erected as security for the balance. In equipment of a municipal or public nature, the guarantees of local officials are often added to the security. The American technical representative of a well-known company writes with reference to electrical machinery that at present there is excessive competition indulged in by foreign firms, and any American exporter desirous of obtaining a foothold in the market must be content with small returns as long as present conditions last. Great emphasis in many instances is placed on price which puts not only electrical but other American machinery at a disadvantage, except in the case of the apparatus of the largest manufacturers. This is true for the reason that technical knowledge is lacking in China on the part of all but an extremely limited number of purchasers. Consequently few customers are in a position to judge the relative merits of machines offered and price becomes to a large extent the standard by which suitability is determined. This is directly responsible for the keen, low-priced, small-profit condition of the present day. Education will do much in time to alter this. Foreign competitors seek in this low-priced campaign to secure a footing against the time when development is more general, demand more generous, and education such as to render small margins unnecessary. One thing is certain, the industrial machinery business in China cannot be carried on without local representation of some sort. Catalogues alone are useless. Some of the important American houses are already in the field with technical experts operating independently or in conjunction with locally established firms, and these, I am told, have made headway. Personally, I have faith in American organisation, alertness and general ability to get business, if gone after properly. For this reason I believe firmly in the co-operative scheme for houses having lines not sufficiently important as yet to warrant individual direct effort, but certainly entitled to the fair trial that only such representation can give. This is peculiarly applicable to houses producing industrial and other machinery, and such an organisation supported by bank affiliations should be in a position to secure a larger proporation of this expanding trade than the United States is getting at present. It is the plan of the competitors, and is at least worth the most thorough investigation if not a trial."

Brazil.—The British Consul at Santos, reporting on the dock works there, states that electric cranes to the number of 14 have already been erected on a new stretch of quay, and an installation of electric conveyors for the loading of coffee has also been fitted up. On April 16th, 1911, the Dock Co.'s hydro-electric installation at Itatinga, about 20 miles from Santos, the transmission cables and central station at Outeirinhos (Santos) were completed. The large surplus of power which the Dock Co. is prepared to supply at a very moderate price for industrial purposes would seem to afford a good opening for the establishment of factories, suitable building land with railway facilities being available. In the town of Santos the tramway system comprises about 38 miles of line, of which 15 miles were electrified in 1909. The electrification of the remaining 23 miles was taken in hand in 1911, and should be completed by the end of 1912.

Finland.—The British Consul at Helsingfors, in a recent report, states that all goods connected with electrical machinery, &c., are supplied by Germany in far greater quantities than by the United Kingdom, with whom Sweden also competes in this trade. There does not appear at present to be any means by which the British import trade can be improved in such articles as telephones (received exclusively from Sweden), lamps, bells and other apparatus ; but in electrical machinery, motors, &c., the United Kingdom might well compete, and is doing so to some extent, although the import is as yet insignificant. It should be noted in this connection that Finland is a country with great wealth in water power, and that turbines and electrical machinery must needs be used in large quantities. It therefore appears extremely probable that the importation of the latter goods will improve, as it is considered that the local factories will not be able to meet the demand. There should thus be an opening for a thorough study of the Finnish market in this trade, and for an attempt to supply, if possible, the particular article required.

The British share of the import trade in suction gas and other engines is important, and, it is considered, might be improved. It is difficult to say whether the import trade in this line developed in 1911, as no separate statistics are available, but it should be mentioned that engines of all kinds are largely employed in Helsingfors for boats, cars, building works, &c. As regards machinery in general, imports from the United Kingdom decreased. In order to further British commercial interests in Finland, the system of establishing local agents for the different branches of trade should be continued. The best manner of obtaining suitable agencies for any particular class of goods is to advertise in a local journal.

Much can be done for British trade in Helsingfors, and in the other Finnish towns by sending out representatives of British manufacturing firms to push the sale of the various commodities. Much good has, no doubt, been already accomplished by this method, but much still remains to be done. The representatives in question should possess a knowledge of Swedish, though, as an alternative, German would also be useful in a minor degree. It is perhaps unnecessary to add that such representatives should possess good manners and tact—qualities which experience shows go a very long way in obtaining the footing required. As time goes on a knowledge of Finnish will probably become necessary,

but at present Swedish is the principal language required in commercial circles.

The British Vice-Consul at Viborg states that the extension of the electrical plant of that town has been practically carried out. The electric tramway will shortly be inaugurated by the municipality, and is expected to be ready for public use by the end of 1912.

For Sale.—Mr. G. E. Corfield, the Receiver, is inviting offers for the sale, by tender, of the business of the Davis Electrical Co., Ltd. (in liquidation), 17, Moor Street, Cambridge Circus, London, W.

The Dundee Town Council has 50 arc lamps for sale. See our advertisement pages to-day.

Book Notices.—"Memorandum and Articles of Association of the I.E.E." "*Journal* of the I.E.E.," Vol. 49, No. 214. London: E. & F. N. Spon, Ltd. Price 5s.—The issue for July, 1912, contains the following papers:—"High-Voltage Tests and Energy Losses in Insulating Materials," by E. H. Rayner; "Self-Contained Road Vehicles and Locomotives," by J. C. Macfarlane and H. Burge; "Tariffs for Electrical Energy," by W. W. Lackie; "Specifications," by Fred. S. Sells; "Power Station Working," by J. W. Jackson; "Porcelain Line Insulators," by J. Lustgarten; "An Instrument for the Detection of Combustible Gases and Vapours," by Louis J. Steele; "The Determination of the Efficiency of a Polyphase Asynchronous Motor from the Current (circle) Diagram," by John Nicholson; "The Tungsten Filament Lamp on Alternating Current," by Lancelot W. Wild.

"*Telephony's*" *Directory of the Telephone Industry*. Chicago, U.S.A.: *Telephony* Publishing Co.—This manual, now in its 17th year, gives a complete list of the telephone companies operating in the United States, Canada, Mexico and the American dependencies—amounting in the aggregate to no fewer than 21,952 (21,048 in U.S.A., 855 in Canada, and 49 in the other countries). Of this remarkable total, 11,518 are returned under the head "number of subscribers unknown," 4,087 with under 50 subscribers, and 2,087 from 50 to 150; at the other end of the scale there are 35 companies with over 10,000 subscribers, 66 with 5,000 to 10,000, and 510 with 1,000 to 5,000. The State of Iowa alone possesses 3,787 companies, and two other States confess to more than 1,100 each, showing that the conditions obtaining in the American telephone field present a striking contrast with British practice. A list of foreign telephone companies and buyers, occupying 2¼ pages, is followed by an account of the "Bell" organisation (the American Telephone & Telegraph Co.) and its associated companies, filling nearly 20 pages, and a section is devoted to the telegraph, cable and wireless companies of the world. Part II of the volume is a "Buyers' Guide," and is provided with maps of the United States and Canada. Nothing could give a more striking impression of the vast development of the telephone industry across the Atlantic than this work, which deals with conditions absolutely unknown in Europe. The magnitude of the industry is also well illustrated by the lengthy list of manufacturers and dealers whose names and advertisements are printed in the second part, forming about half the volume.

"British Standard Specifications." A new edition of the British Standard Specification for Structural Steel for Bridges and General Building Construction (Report No. 15. Revised August, 1912) has recently been issued. The new issue is of importance in view of the fact that the London County Council (General Powers) Act, 1909, requires that all rolled steel used in the construction of skeleton frame work for buildings shall comply with the requirements of this specification. The price of the specification is 5s. 2d. post free, and it may be obtained from any bookseller, or direct from the offices of the Committee, 28, Victoria Street, Westminster, S.W.

"*Calendar* of the Royal Technical College, Glasgow, 1912-13." Glasgow: The College.

"Electrical Injuries: Their Causation, Prevention and Treatment." By Charles A. Lauffer. 1912. x London: Chapman & Hall, Ltd. Price 2s. net.

"The Constituents of Coal Soluble in Phenol," by J. C. W. Frazer and E. J. Hoffmann; "The Factor of Safety in Mine Electrical Installations," by H. H. Clark; "The Status of the Gas Producer and of the Internal Combustion Engine in the Utilisation of Fuels," by R. H. Fernold; "The Slagging Type of Gas Producer," by Carl D. Smith; "Government Coal Purchases under Specifications," by G. S. Pope and J. D. Davies. 1912. Washington: Government Printing Office.

"*Bulletin* of the American Institute of Architects." Vol. XIII, No. I. April, 1912. Washington: The Institute.

"Wireless Telegraphy." By Alfred T. Story. 1912. London: Hodder & Stoughton. Price 1s. net.

"*Proceedings* of the Incorporated Municipal Electrical Association, 1912." London: Wyman & Sons, Ltd. Price 5s.

We have received from Mr. J. Sutherland Warner a reprint of correspondence in the *Times* of March and April, 1910, relating to "Mono-rail Fallacies," in which the relative merits of the mono-rail and the ordinary permanent way were discussed.

Catalogues and Lists.—The Electrical Co., Ltd., 122-124, Charing Cross Road, W.C.—Lists Nos. 1 and 2, dealing with electric motors; list No. 1 relates to D.C. machines, from ¼ to 100 H.P., which are built in three standard types according to size; it contains very full information regarding the motors and their capabilities, as well as particulars of small motor-generators, starters, &c. Useful notes are given as to the management of the machines, and tables of dimensions are provided. List No. 2 deals with A.C. motors of slip-ring and squirrel-cage types, in several ranges, from ¼ to 500 H.P., and for one, two or three-phase supply. Commutator machines are also listed, together with starting switches and transformers and spare parts, and a number of diagrams of connections. Running instructions and dimension tables are given. Both lists have been compiled with a special eye to the requirements of contractors, and are very conveniently arranged.

The Cable Accessories Co., Ltd., Britannia Street Works, Tividale, Staffs.—Catalogue No. 6 of electric light "Sceaco" water-tight fittings; the company specialises in cast-iron fittings, and the list shows a great variety of these for use on board ship, in docks and factories, mines, &c., and for street lighting, with one or more incandescent lamps. Ironclad D.P. switches and fuses for street lighting, and ornamental brackets of numerous patterns for use with the fittings, are included, as well as hand-lamps complying with the Home Office Regulations, and a variety of accessories.

The I.T.E. Electric Co. (1907), Ltd., 72, Finsbury Pavement, E.C.—Card showing the Midget Senior I.T.E. circuit breaker for five to 300 amperes, and the L.L. traction type, of which hundreds are used by the L.C.C.

Deutsche Gasgluhlicht A.G. (Auergesellschaft), Berlin O 17.—Catalogue of reflectors, fittings, and installation materials for use with Osram wire lamps.

Allgemeine Elektricitats - Gesellschaft, Berlin.—Brochures giving particulars and illustrations of generating plant and of electrically-driven pumps, air-compressors and fans, installed by the company in numerous gas-driven power stations for mining, ironworks, &c.

C. W. Hunt Co., West New Brighton, New York, U.S.A.—Pamphlet describing the Hunt Automatic Railways for handling materials in bulk; some of these installations have been working satisfactorily for 40 years.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, N.E.—Price list No. D6, dealing with Holophane fittings, reflector-bowls and spheres, with a variety of fittings for use with Holophane glassware. Also a leaflet illustrating nine of the newest patterns of household Holophane.

The Universal Electrical Manufacturing Co., 14, Station Parade, Peckham, S.E.—Calendar card with prices of porcelain tubular fuses with protected ends. The company has built a foundry for brass, gun-metal and aluminium castings, and is now prepared to supply rough or finished castings to pattern or to drawing.

The Langdon-Davies Motor Co., 110, Cannon Street, E.C.—Price list of standard A.C. motors of the slip-ring and short-circuited rotor types, from ⅛ to 100 B.H.P., conforming to the Engineering Standards Committee's specification; also geared motors, starters, motor-generators, &c.

The Electrical Apparatus Co., Ltd., Vauxhall Works, South Lambeth Road, S.W.—Leaflet relating to the E.A.C. high-torque meter.

Messrs. Seear, Page & Co., 16 and 17, Devonshire Square, E.C.—Pamphlet describing the Swedish system (Löfquist patents) of electric heating apparatus—laundry, domestic, &c.

Messrs. Wailes, Dove & Co., Ltd., 5, St. Nicholas Buildings, Newcastle-on-Tyne.—Booklet about Bitumastic solution for coating ironwork.

The Sloan Electrical Co., Ltd, Conradty House, 12, Golden Lane, E.C.—Price lists relating to "S. L." shades and reflectors, of glass, metal and silk, in great variety; and "S. L." cartridge fuses, "pyrotin" fuse wire and strip, "bi-metal" fuse wire, &c. These can be had on application to the company.

Messrs. Schaffer & Budenberg. Ltd, Whitworth Street, Manchester.—Price list of indicators (Catalogue Section 19) of the Thompson type, with a variety of modifications and recent improvements, as well as the Richards indicator, explosion recorders, electrically-controlled indicators, and a variety of reducing gears, tools and accessories.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, E.C.—Leaflets relating to aluminium domestic fittings, such as door handles, &c., and aluminium ventilating fans for attachment to electric motors.

Messrs. Samuel Denison & Son, Ltd., Leeds.—Pamphlet describing the "Blake-Denison" weigher, which automatically and continuously weighs and records the quantity of material passing over any type of conveyor, within ½ per cent. A semi-automatic weigher and various other types of machine are described, and a new time tonnage recorder for secret control, electrically operated at any distance from the weigher, is introduced. An explanatory statement regarding these devices is given in a separate pamphlet.

The Brimsdown Lamp Works, Ltd., Kingsway House, W.C.—We have received a copy of a large showcard advertising "Wirum" lamps for 1912; the card measures 15 × 20 in., and is printed in eight colours, with striking effect. It is for general distribution to the trade.

Austria.—According to the *Electro. und Masch.*, the imports of electrotechnical products into Austria-Hungary in the first five months of the year amounted to 16,124,000 kronen, against 11,168,000 kronen in the same period in 1911. The exports were 5,134,000 kronen, against 4,530,000 kronen. Of dynamos the imports were 5,934,000 kronen, against 4,192,000 kronen, and the exports 491,000 kronen, against 206,000 kronen. Compared with the previous year, the growth in the aggregate imports, and more particularly in dynamos and electrical apparatus, was maintained, although compared with the preceding month's imports, a noteworthy falling off was observable. The exports, also compared with those of the previous month, showed a decline, although they were 25 per cent. greater than in the same month last year. The advance in the exports of glow lamps was less marked than in the previous year, but cable and wire both showed considerable improve-

ment. The United Kingdom figured in the imports, principally in dynamos, transformers, &c.; telegraph, signalling and safety railway apparatus; telephones and microphones; cable and insulated wire; accumulators; and electrical meters, the bulk of Austro-Hungarian trade being with the German Empire. Of the exports, the United Kingdom were the recipients of small consignments of dynamos, telephones and microphones, electrical meters, glow lamps (153 quintal), armoured cable and insulated wire (91 quintal), rubber or gutta-percha covered wire (33 quintal), paper, &c., covered (208 quintal), carbons (1,113 quintals) and electrodes. Moderate exports were made to British India, but Egypt apparently is a good customer for Austro-Hungarian electrical products.

Liquidation.—Lahmeyer Electrical Co., Ltd.—A general meeting of the company will be held at the office of Messrs. Slaughter & May, 18, Austin Friars, E.C., on October 1st, to receive the report of the liquidator on the winding up of the company's affairs.

Bankruptcy.—G. E. Hervey, gas and electrical engineer, of 24, Susans Road, Eastbourne. Last day for receiving proofs, September 13th, 1912.

Trade Announcements.—The Diesel Engine Co. announce that in consequence of the expansion of their business they are removing from Queen Victoria Street to more commodious head offices at General Buildings, Aldwych, Strand, London, W.C. All communications should be sent to the new address.

The Consolidated Diesel Engine Manufacturers, Ltd., also announce that their registered office is now removed to General Buildings, Aldwych, London, W.C.

Messrs. W. T. Glover & Co., Ltd., announce that the telegraphic address of their London office will henceforth be "Phonoscope, Vic., London." The indicator word, "Vic," will not be charged for in inland messages.

LIGHTING and POWER NOTES.

Accrington.—The electricity department has just commenced the work of laying a new high-pressure cable towards Clayton-le-Moors in preparation for the supply of current to the township. It is also probable it will be requested to quote for the supply of current to Great Harwood

Arnside.—By arrangement with the Traders' Association, the first section of the promenade electric lighting scheme has been brought into use. The work has been undertaken by the traders, in the hope that the P.C. may see its way to take over the scheme eventually.

Barrow-in-Furness.—At the T.C. meeting on September 2nd, the Electricity Committee reported that the engineer had submitted terms by which, subject to approval, he agreed to give the Furness Railway Co. a supply of electricity for the whole of their locomotive works at Barrow, for a period of 10 years. It was decided to grant approval, subject to the company entering into an agreement to the approval of the town clerk. The Council also endorsed the engineer's proposal to authorise the contractors to proceed with the work in connection with the buildings for the extension of the electricity works, and the town clerk was instructed to write the L.G.B., informing it of the proposal.

Belfast.—The site for the new electricity station, which the Corporation proposes to erect, will probably be that known as Glentoran, on the Ravenhill Road. The Tramway and Electrical Committee has recommended the Council to accept this site (which covers between five and six acres), at an annual rental of £65 per acre. A meeting of the Council in committee has been called to consider the recommendation, and also the reports of the electrical engineer, and the consulting engineer on the electrical extension question generally. The Glentoran property has a frontage to the Lagan. Another site which was examined by the sub-committee of the Tramways and Electrical Committee was at Queen's Bridge.

An experimental installation of arc lighting has been introduced in Donegall Street, this being an extension of the system which has already been in use for about three years in Castle Place and High Street. We gather that centre lighting has been adopted by poles and span wires.

Bettws-y-Coed.—With reference to the Council's proposal to borrow £9,700 for water supply and £3,720 for electric lighting schemes, an inquiry has been held by the L.G.B. Regarding the latter, it was stated that Lord Ancaster had agreed to lease to the Council the well-known Swallow Falls, so that the Council, by making a small charge for admittance, could secure at least £100 annually towards the estimated deficit of £212. His lordship had also offered to contribute £100 a year until the deficit was wiped off. Opposition to the scheme was raised by a member of the Council, the latter objecting to the Swallow Falls, which had always been open to the public, being saddled by a charge which would result in harm to the district.

Birkenhead.—Arising apparently out of a discussion on the borough electrical engineer's expenses at the last T.C. meeting, the following notice of motion has been given by Councillor Campbell for consideration at the forthcoming T.C. meeting:—"That the number of days in attending conferences under authority of the resolution of the Special Committee confirmed by the Council on October 6th, 1909, be limited to not more than four days in one year, including day of going and day of returning; and that all proposed attendances at conferences, other than those sanctioned by the Council on October 6th, 1909, be entered in the minutes of the committees concerned."

Bolton.—The annual report of the electricity department shows a total output sold of 11,676,937 units, of which motor supply and tramways accounted for 5,540,319 and 4,468,764 units respectively. The gross profit on the year's working was £32,123; interest, sinking fund and depreciation charges absorbed £26,992, sundry contributions amounted to £1,709, and the balance of £3,422 went to the rates, this figure comparing with £6,837 in the previous year. The calculated depreciation for the undertaking amounted to £19,169, and a sum of £3,943 was therefore transferred to the depreciation account to supplement the loan instalment, which only amounted to £15,226. The depreciation account now stands at £27,673. The decreased net surplus is attributed to the coal strike, which added some £3,000 to the coal bill for the year, and will also affect the present year's working. As the Corporation has unfortunately delayed the construction of the new power station, so that the existing plant will be overloaded during the year, this will still further affect the present year's working—despite the assistance of the 1,000-kw. battery which has been installed for the purpose of getting over the peak loads of the coming winter. This is partly explained by the fact that the Bolton undertaking supplies both single and three-phase alternating current as well as direct current for both lighting and traction. It is interesting to note that 483 consumers used 1,167 motors, of 11,794 h.p., and that a total of 3,108 consumers were supplied.

The Electricity Committee has approved the plans and estimates prepared by Mr. A. A. Day (borough electrical engineer) for the proposed new power station on a site at Back-o'-th'-Bank, for the purpose of meeting the increased demand for current in Bolton. The site is regarded as particularly advantageous, as coal can be delivered from the railway direct on top of the boiler house, and on the other side of the site is the River Tonge, the water of which will be available for condensing purposes. There is ample room on the site for putting down a generating station of very large dimensions. The initial capacity of the plant will probably be two 4,000-kw. turbo-alternators generating three-phase current, 50 cycles, at 6,500 volts. In addition to the river, there will be extensive reservoir capacity for condensing water. The scheme only awaits the sanction of the L.G.B. to be proceeded with.

The L.G.B. has sanctioned the borrowing of £19,000 for electricity purposes.

Carlisle.—The annual report of the electricity department shows total sales of 2,317,435 units, as compared with 1,649,211 units in the previous year. The gross profit, £9,971, was £1,202 higher, and the net balance amounted to £3,340, or a trifle less than the previous year. The report points out that various additional expenses were met during the year, but for which the balance would have been greater. The works costs has steadily decreased, and stood at approximately ¾d. per unit. We note that the balance of the net revenue account, after meeting loan charges, &c., amounts to £8,337.

Continental Notes.—Austria.—The favourable progress of the constructive works of the Vienna municipal station on the Leitha-Fischa, gives ground for the belief that the station will be completed in the course of next year, instead of in 1915. The station will be equipped with eight steam turbo-alternators. These will generate three-phase current at 5,000 volts, which will be raised to a pressure of 38,000 volts. The transmission to Vienna will lead through Pottendorf, Oberwaltersdorf, and Mödling. A second line is contemplated to run through Pottendorf, Münchendorf, and Vösendorf. In Oberwaltersdorf, and Mödling transformer stations will be erected, to supply various neighbouring localities. In Vienna the current will be stepped down to the normal Vienna pressure. The final cost is estimated at 6·4 million kronen, but the immediate expenditure figures at 850,000 kronen.—*Der Elektrotechniker.*

Russia.—St. Petersburg.—A fresh element of competition is proposed to be introduced in connection with the supply of electrical energy in St. Petersburg. At present the business is in the hands of (1) the St. Petersburg Electric Lighting Co., of 1886, in which German manufacturing firms are indirectly interested through their association with the Zurich Bank for Electrical Enterprises, and the Berlin Electric Light and Power Investment Co., both of which are large shareholders in the Russian company; (2) the Belgian Société d'Eclairage Electrique; and (3) the latter's subsidiary the Compagnie Auxiliaire, which acquired in 1909 and subsequently, the majority of the shares in the St. Petersburg (Helios) Electrical Installations Co. The Electric Lighting Co., of 1886, as was mentioned in this journal a short time ago, recently secured control over a portion of the Little Imtra Falls in Finland, with the object of establishing hydro-electric works, partly for the purpose of supplying light and power in Finland, and partly for creating a reserve for the increasing requirements in St. Petersburg. It is proposed to form a special Finnish company to carry out the undertaking, which is stated to have already involved an expenditure of over £200,000 for the purchase of the water-power rights. In the meantime, Belgian and other interests have been at work in a similar direction, as it is announced from the Russian capital that Imperial sanction has just been given to the St. Petersburg Electrical Transmission of Power Co., which is also to utilise water

power in Finland. The promoters of the new company are headed by the Brussels banking firm of MM. P. & S. Mottar, and the company has acquired water falls in Finland and the rapids of Volkhow, together with adjacent sites, and is also declared to have assured itself of the right of way for the erection of mains to St. Petersburg. Five leading Russian banks have participated in the scheme, including the Russo-Asiatic Bank, whose director—Excellency Putiloff—has been elected chairman of the new company. The announcement omits to state whether the transmission company has obtained a concession to supply electrical energy in St. Petersburg in competition with the three existing companies. At any rate, it is calculated that the execution of the scheme would necessitate the expenditure of £2,500,000. At the same time it is known that the Russian Ministry of Communications is inquiring into the question of the transformation of the railways in the neighbourhood of the Russian capital to electric traction, although there is nothing at present to connect this matter with the new scheme for the utilisation of Finnish water powers.

The British Vice-Consul at Omsk has forwarded a copy of a pamphlet (in Russian) giving particulars of a proposed electric lighting and tramway system for Omsk. The pamphlet may be seen by British contractors at the Commercial Intelligence Branch of the Board of Trade.

Belgium.—Under the auspices of three colliery undertakings in the Liége district, a company has just been formed in Brussels with a capital of £24,000, and the title La Société d'Electricité de Genck, with the object of establishing a central station for the supply of the electrical energy required for lighting and power purposes at the collieries interested.

La Société des Produits de Flenu is reported to be about to establish an electric lighting and power plant at its collieries at Jemappes.

Norway.—A capitalist group represented by Director Blakstad, of Lillehammer, intends to erect a power station on the Aur Elf, and to build a dam 40 m. high across the Aur Lake. Local officials have lodged a protest against the scheme, as being likely to prejudicially affect the fisheries, the wood and moor industries, and cattle raising; on the other hand, the district representative is in favour of it owing to the dues which, according to the new water law, will fall to his office. It is intended to build a tunnel from Lake Aur to Sundal, by which some 200,000 H.P. will be provided. An alternative plan is mooted whereby a total of 250,000 H.P. will be provided. When completed, this station will be the largest in Norway, and one of the largest in the world, larger than the Rjukan Falls station in Sweden. The cost is estimated at 38,000,000 kronen.—*Elek. und Masch.*

It is also reported in the Press that a Norwegian company is to be formed to work a French electro-chemical patent for the manufacture of "a new product connected with the nitrogen industry, which has practically not been manufactured for sale before, but which has been produced experimentally for some years." It is said that this new industry will require a large amount of water power and capital, a sum of about £556,000 being mentioned in this connection.—*Board of Trade Journal.*

Cuba.—The *Gaceta Oficial* (Havana) publishes decrees authorising Senores Rovira y Hermano to install a hydro-electric plant in Trinidad, intended for lighting and other industrial purposes; and the Compania Cubana de Alumbrado de Gas, of Cienfuegos, to install in Cienfuegos, a central power station for the purpose of generating electric energy for lighting and industrial purposes.—*Board of Trade Journal.*

Darwen.—The T.C. has proposed to make application to the L.G.B. for sanction to borrow £450 for electricity works extension, and for a new cable from the electricity works to the Circus.

Dorking.—The U.D.C. has consented to Edmundson's Electricity Corporation, Ltd., laying a new cable along London Road, at an estimated cost of £250, to more effectually serve the extended area of supply at Westhumble.

Llandudno.—On the Electricity Committee's recommendation the U.D.C. has decided, for the sake of uniformity, to light the promenade extension to the foot of the hill in the direction of Craigside, at an estimated cost of £134.

A recommendation has also been made that six electric columns be placed on the west shore immediately the scheme for the levelling and turfing of the promenade there has been agreed upon.

London.—Shoreditch.—The accounts of the Electricity Department, to be submitted to the B.C., show that 7,890,973 units were sold in the year ending March 31st last, as against 6,994,710 for 1910-11. The net surplus on the year's working was £5,326, although the department had to pay £1,000 more in rates than in the previous year.

Maidenhead.—On Wednesday the 6-ton fly-wheel of a Diesel generating set in the electricity works burst, the pieces of the fly-wheel being hurled through one end of the building. One man was injured, and it was feared that the supply would be interrupted, but, fortunately, the staff were able to meet the whole of the lighting requirements of the town, except street lighting, by means of the steam generating plant.

Mexico.—The Mexican Northern Power Co. is making an investment of $80,000,000, which will cover the construction of dams, erection of buildings, installation of machinery, provision of transforming stations, stringing of wires and the creation of auxiliary plant. It is estimated that the company will be able to develop 30,000 H.P., and so good is the progress being made that it is expected power can be delivered next summer.—*Financier.*

Maidstone.—The B. of T. has granted the T.C. an Order authorising it to supply current to Allington Castle and the Castle Quarries, Allington, which are outside the borough.

Mansfield.—At a meeting of the Mansfield Board of Guardians, last week, the Building Committee recommended that tenders be invited for installing electricity in the house, the estimated cost of which was £500. It was stated that the approval of the L.G.B. had been given for the work to be carried out.

Newcastle-Emlyn.—The Urban Council having disdisagreed to the electric supply company increasing its charges for street lighting since the number of lamps was increased, has decided to replace the old oil lamps. This was necessary, as the electric supply to the lamps has been cut off.

Newmarket.—The question of public lighting, tenders for which have been received from both the Electricity and Gas companies, has been under consideration by the U.D.C. The gas company, which at present lights the streets, has hinted that the price (3s. 8d. per 1,000 cb. ft.) to ordinary consumers will have to be increased by 3½d. in the event of its losing the public lighting.

New Zealand.—It appears that a proposal is under consideration for the substitution of electricity in place of gas for the lighting of the town of Oamaru, at an estimated cost of £10,000. It is proposed to utilise the excess water supply in connection with this scheme.—*Board of Trade Journal.*

Northampton.—A serious failure in supply, which is attributed to flood water getting into street boxes, occurred one day last week, when numerous factories in the east end of the town were compelled to wholly, or partly, close down for one morning.

Peterborough.—The T.C. has applied to the L.G.B. for a loan of £500 for services. The engineer has been instructed to prepare reports and alternative estimates for extensions to the generating plant by a high-tension alternating-system and low-tension continuous-current system, at the discretion of the Committee.

Stretford.—At the generating station at Longford Bridge controlled by the Council, the storage battery has been replaced by one of larger capacity, comprising 268 cells of 738 ampere-hours' capacity, to deal with the requirements of the Old Trafford district, especially during the football season, and it has been found necessary to install a three-wire booster to deal with a maximum load of 1,200 amperes for private lighting in Old Trafford. Further projected extensions include a negative feeder booster and switchboard, together with five miles of '8 lead-covered cable, all this being required to meet the demands of patrons of the Manchester United Football ground at Old Trafford.

Talgarth.—The Talgarth Electric Supply Co. has contracted to light the town lamps, and has already put in a number of installations.

Wallasey.—On August 30th a L.G.B. inquiry was held by Mr. Ekin into the application of the T.C. for sanction to borrow £6,980 for purposes of electricity, &c. The town clerk stated that the amount required for the electricity undertaking represented the cost of the provision of a Diesel oil engine and alternator to be placed in the electricity works, which was rendered necessary owing to the extremely rapid growth of the supply of electricity. There were now 3,115 consumers, and the number was rapidly increasing. Mr. Crowther, electrical engineer, said that by the use of oil fuel they would save 1,500 tons of coal per annum.

TRAMWAY and RAILWAY NOTES.

Barking.—According to the statement of accounts for the year ended March 31st last, there is a deficit of the working of the tramway undertaking of £5,242. After allowing for £4,500. voted out of the district rate in anticipation of this deficit, there remains a sum of £742 still to be met from the same source. The total revenue for the period under review amounted to £6,785, £4,737 of which was derived from passenger traffic. The total capital expenditure up to March 31st last totals £81,369, while that for 1911-12 is put down at £1,321, this amount being spent on cars.

Chester-le-Street.—An attempt is being made to induce the Gateshead and District Tramways Co. to extend its service through to Chester-le-Street, with branches into the thickly populated areas around. The Chester-le-Street Rural and Urban District Councils and Birtley Councils are bringing all possible pressure to bear on the company, and practically all the other local authorities are in favour of the proposal. Generally it is suggested that either railless traction, or even motor-'buses would meet the requirements of the district.

Continental Notes.—Turkey.—The engineers of the Berlin firm of Lenz & Co., who obtained a concession last February for the construction and working of a Bosphorus electric railway from Galata *via* Pera, and the villages on the European side of the Bosphorus to Rumeli-Kavak, are actively employed on the survey o the route and the preparation of the detailed plans, which are

expected to be completed early in October. It is then proposed to form a Turkish company, with a capital of £1,600,000 to carry out the work, and one half of the money will presumably be raised by German interests, and the other half by two French groups and one Belgian syndicate. The Constantinople Tramways Co., which is at present engaged on the conversion of its lines to electric traction, will shortly call up the remainder of the share capital for this purpose. It is intended to provide further capital by the issue of a debenture loan.

AUSTRIA.—The Austrian State Railway authorities are considering a scheme to put down a plant near Knittelfeld, Styria, to utilise the water-power of the River Mur in the generation of the electrical energy required in connection with the electrification of the railway between Leoben and Knittelfeld.

The preliminary surveys have been authorised for an electric network of railways extending from Sebrowitz to Jundorf, and along the Schwarzawa River to Brünn, Königsfeld, Rzeczkowitz and Schimitz, with various branches. Consulting Engineer A. O. Samohrd, of Brünn, is the expert member of the Representative Committee, concerned with the scheme.—*Der Elektrotechniker.*

GERMANY.—It is proposed to adopt electric traction on the Gleiwitz-Ratibor Light Railway in Upper Silesia.

A scheme for the construction of an electric tramway between Mannheim and Lampertsheim is at present under consideration.

RUSSIA.—The Belgian Compagnie des Tramways et de l'Electricité en Russie intend connecting Riga with the seaside resort of Majorenhoff by an electric tramway. For this purpose a subsidiary company, with a capital of 15,000,000 fr., has been formed, and a beginning of the constructive work is about to be made.—*Elek. und Masch.*

Elland.—The Halifax and Huddersfield Corporations are proposing to make extensions of their tramway systems to Elland, in the former case *via* Woodside, and in the latter case from Birchencliffe to Elland Town Hall. The Huddersfield proposal has received the support of the Elland District Council, and a public meeting of the ratepayers is to be held shortly to consider the matter.

Hebden Bridge.—The U.D.C. has decided to ask the Halifax Corporation to extend its tramway service from the centre of Hebden Bridge to Whiteley Arches. The Halifax Corporation, it was stated, had previously given a verbal guarantee to run its cars to the place named.

Leeds.—Important developments of the tramway system are to be considered by a special sub-committee of the Corporation Tramways Committee. The continuation of the Pudsey line to meet that of Bradford and the extension of the York Road route to Seacroft and Crossgates, and a probable branch to Shadwell, are amongst the suggested developments. Another suggestion deals with the extension of the railless traction system from Farnley to the present terminus of the Morley tramways *via* Drighlington.

Liverpool.—The general manager has been instructed to report on the desirability of establishing a motor-'bus service on the dock road and vicinity.

Manchester.—According to a Manchester paper a a deadlock occurred at the last meeting of the Tramways Committee over the tenders received for the supply of special track work. A motion was made that the tender of the Lorain Steel Co., of U.S.A., amounting to the sum of £10,231, be accepted, whilst an amendment was proposed that the Committee adhere to its previous resolution of July 23rd, accepting the tender of Messrs. Edgar Allen & Co., Ltd., amounting to the sum of £11,038. The amendment was carried by a majority of one, but on being put as the substantive motion seven voted for it and seven against. The chairman declined to give a casting vote, and it was, therefore, decided to leave the matter to be further discussed by the City Council. On Wednesday, the latter decided to award the contract to the Lorain Co., only one dissentient voice being raised against the proposal.

Preston.—The elective auditor's report on the tramways shows an increase of £2,581 in the receipts from the electric cars compared with the previous year. The earnings per car-mile are 10·34d., against 9·91d., whilst the working expenses per car-mile are the same as the previous year, viz., 5·96d. The cost of repairs of cars has gone up £524. The cost of fitting up the new offices was £527. The surplus for the year was £6,241, which had been added to reserve, thereby increasing that fund to £31,466. The sinking fund amounted to £37,199 whilst expenditure on capital account stood at £187,269. Reserve and sinking funds were now equal to over one-third of the capital outlay—a very sound position. Loans had been reduced by £4,110, and the amount in the bank had increased £7,316.

Quarry Bank.—The B. of T. has confirmed the Quarry Bank and District Light Railway Transfer Order, 1912. A London company has taken over the order, and undertakes to construct the lines within three years.

Stainland.—The U.D.C. has decided to petition the Huddersfield Corporation to include in its forthcoming Parliamentary Bill provision for an extension of the tramways to Stainland. It was also decided to ask the Halifax Corporation to bring its tramways to Stainland, so that the district could be connected up both ways.

Stalybridge.—The local Trades and Labour Council has forwarded a resolution to the Joint Board protesting against an increase in workmen's fares, which is to come into operation on October 1st. It appears that ½d. fares are to be abolished, and that return tickets will cost more; also that only cars leaving before 8 a.m. instead of 8.30 will be available for such tickets.

West Hartlepool.—The scheme of the T.C. for the municipalisation of the tramways in the borough was completed on August 30th, when the Seaton Carew section, and that part of the West Hartlepool and Hartlepool route situate in West Hartlepool, came into the possession of the Corporation. It is two years since the scheme was started, a commencement being made by the purchase of the Foggy Furze and Park sections at a cost of about £13,000. The purchase price of the Seaton Carew line was about £22,500, and that part of the Hartlepool line situate in the borough of West Hartlepool, including power station, sheds, &c., cost about £23,000, which, with £4,000 expended on relaying the Park route permanent way, makes the cost of the entire system roughly £62,500. The lines in the borough of Hartlepool are being leased at an annual rental of £500 a year. The West Hartlepool Corporation has recently obtained power to extend the present system, the extent of which is 7 miles.

TELEGRAPH and TELEPHONE NOTES.

Atlantic Cable Rates.—Modified rates for Atlantic cable Press dispatches came into operation on the 1st inst. The new tariff provides for rates varying from 3½d. to 6½d. for ordinary messages, and from 2d. to 4d. per word for deferred messages. The Deferred rates will be applicable as from America between the hours of 1 and 4 p.m., and midnight and 6 a.m., New York time, and from England between midnight and 6 a.m. London time.

London Telephones.—It is intended to open six new telephone exchanges in the London area. Since the Post Office took over the working of the telephones last January, 18,000 new orders for installations have been received.

The reduced rates for the use of trunk telephone lines during the slack hours of the day have now come into force. The hours in question are before 10 a.m., between 1 and 2 p.m., and between 4 and 7 p.m., and the reduced charges for conversations longer than the customary six minutes are as follows:—

First and second quarter-hour periods, three-quarter full trunk charges.

Third and fourth quarter-hour periods, half trunk charges.

Each additional hour, quarter full charges.

The minimum time allowed under these charges is 15 minutes, and each subscriber taking advantage of the facilities will be obliged to sign an agreement for a period of at least a month.

South Africa.—The Government has just completed the equipment of a new telephone exchange in Cape Town on the central-battery system. In all a sum of about £75,000 has been spent in Cape Town and the suburbs on the exchange equipment and underground conduits and wires for subscribers' connections. It is intended to inaugurate the tariff system of payment for calls.

The U.S.A. and the German Trans-Atlantic Wireless Scheme.—It has previously been reported that the High Frequency Co., of Berlin, or rather the international company to be formed by it, proposes to erect a wireless station near New York for communication with a similar station now in course of construction in Germany. It would appear, however, that difficulties in the matter have arisen across the Atlantic. According to a German commercial newspaper published in New York, the attention of the United States Government was drawn to the project by a prominent member of a New York club. As the station is intended to be built at no great distance from similar stations belonging to the navy, the naval authorities dispatched officers to Sayville to make an inquiry, and the Department of Commerce also sent representatives to the same place. The result of the investigation probably influenced the text of the law recently adopted by the House of Representatives, which is intended to put an end to the evils and abuses which have resulted from the establishment and working of wireless stations by unauthorised persons, and which were specially brought to public knowledge on the occasion of the *Titanic* catastrophe. Nevertheless, the German newspaper submits that it is a peculiar coincidence that, whilst the United States Congress should be occupied with legislation which permits the working of wireless stations only by those persons who have obtained a concession from the Federal Department of Commerce and Labour, German interests should be entering upon such an expensive and far-reaching enterprise in the United States without being able to reckon with certainty on receiving a concession from the Federal Government.

Trans-Pacific Wireless.—With regard to reports of long-distance wireless communication across the Pacific (between San Francisco and Honolulu), which the Federal Wireless Telegraph Co. claim to have established by means of the Poulsen system, we are informed that Marconi's Wireless Telegraph Co., Ltd., are erecting at these places stations of the same type as those which it is proposed to construct for the British Imperial scheme. The new Marconi station at Honolulu has been so designed as to enable wireless communication to be established at a little later

date, with similar stations to be erected by the Marconi Co. at Yokohama and in the Philippine Islands. We are also informed that the Marconi Wireless Telegraph Co. of America have commenced proceedings for infringement of patent against the Federal Wireless Telegraph Co.

Wireless for Boy Scouts.—Mr. Godfrey C. Isaacs, managing director of the Marconi Wireless Telegraph Co., has presented the British Boy Scouts with a complete portable knapsack station. The Marconi Co. are anxious that every Boy Scout should have a practical knowledge of wireless telegraphy, and have offered to present a complete outfit to the troop which provides the first Scout capable of passing the examination of a second-class Marconi operator.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberaman.—September 11th. Electrical fittings, for the Powell Duffryn Steam Coal Co., Ltd., 101, Leadenhall Street, London, E.C. Stores Manager, Aberaman, near Aberdare (Form No. 26).

Australia.—NEW SOUTH WALES.—September 25th. Trunk line switchboard, for the P.M.G.'s department. See "Official Notices" August 23rd.

October 2nd.—N.S.W. Government Railways. Six 1,000-KW. sub-station units to specification No. 357. Specification (10s.) from Electrical Engineer's Office, 61, Hunter Street, Sydney.

October 16th.—N.S.W. Government Railways. Two 5-ton electrically-driven travelling cranes, for the Randwick workshops. Specification No. 365 (5s.). Electrical Engineer's Office, as above.

SOUTH AUSTRALIA.—October 1st. Telephone switchboards at Unley, Adelaide, for the Postmaster-General's department. See "Official Notices" August 23rd.

October 1st.—Telephone switchboards at Norwood, for the P.M.G.'s department. See "Official Notices" August 23rd.

October 22nd.—Telephone switchboard at Port Adelaide, for the P.M.G.'s Department. See "Official Notices" to-day.

October 23rd.—100 common-battery table telephones, for the P.M.G.'s Department. See "Official Notices" to-day.

VICTORIA.—September 17th.—One fuel economiser, for the Melbourne Corporation electricity works.

October 2nd.—Two vertical sets of electrically-driven rotary pumps, for the Melbourne City Council. See "Official Notices" August 16th.

October 22nd. Fourteen sections of common-battery multiple switchboard, for the P.M.G.'s department. See "Official Notices" to-day.

WESTERN AUSTRALIA.—November 5th. Telephone switchboards to Stores Schedules 222 and 223, for the P.M.G.'s department, Perth. See "Official Notices" to-day.

Austria.—VIENNA.—November 30th. Plans are required for the erection and operation of an electrically-worked municipal central clock installation. Particulars, Magistratabteilung V, Vienna.

Belgium.—September 9th. The municipal authorities of Plainevaux (province of Liége) are inviting tenders for the concession for the supply of electrical energy for lighting and power purposes in the town.

Brighton.—September 10th. Electrical fittings for the B.G. Mr. Horace Burfield, Clerk, Parochial Offices, Prince's Street

Bulgaria.—September 9th. The District Administration of Finances, in Sofia, is inviting tenders for the supply of a number of electrically-operated cranes for the Bulgarian State Railways.

October 17th.—The District Administration of Finances in Sofia is inviting tenders for the supply and erection of the mechanical and electrical plant required in connection with the power transmission installation to be laid down at the State collieries at Pernik.

Costa Rica.—December 9th. Tenders are invited for the building and working of an electric tramway between Alajuela and Grecia, a distance of 18,100 m. Particulars from the Secretaria de Fomento, San José.

Grimsby.—September 16th. Automatic balancer for the Corporation. See "Official Notices" to-day.

Leeds.—September 9th. Paper-insulated cables, for one, two or three years, for the City electric lighting department. See "Official Notices" August 9th.

October 7th.—The Tramways Committee of the Corporation invites tenders for the supply and erection of a steel building at the permanent way depôt, Leeds. J. B. Hamilton, general manager.

London.—L.C.C.—September 24th. Electric spark gaps in brick cells for sub-stations. See "Official Notices" August 23rd.

Lossiemouth.—September 28th. Gas producer plant, engines and dynamos, battery, crane, overhead mains and public lamps, for the T.C. See "Official Notices" to-day.

Manchester.—September 10th. One 12,000-KW. three-phase high-pressure turbo-alternator, with condensing plant, &c., water-tube boilers and superheaters, economisers and coal chutes, for the Corporation. See "Official Notices" August 9th.

September 18th.—Electric lighting of Crumpsall Workhouse, for the B. of G. See "Official Notices" to-day.

Middleton.—September 11th. One 300-400-KW. steam dynamo, for the Corporation. See "Official Notices" August 30th.

Newport (Mon.).—September 17th. Coal for the Corporation electricity department for a year. Mr. N. J. Young, general manager, Town Hall (returnable deposit of 10s. 6d.).

September 18th.—Extension of plant at the Corporation electricity works: Railway weighbridge, ash conveyor and bunker, water-tube boiler, flues, and forced and induced draught plant. See "Official Notices" to-day.

Rosario.—October 15th and September 21st. According to the *Review of the River Plate*, the Municipality is calling for tenders, until October 15th, for a second system of electric tramways, including their construction and working. Full particulars from the Municipality. Tenders for the public electric lighting will be opened on September 21st.

Warrington.—September 11th. Electrical sundries, for six months, for the B.G. Mr. A. Bottomley, clerk, Bewsey Chambers.

West Ham.—September 12th. Electrical fittings for six months, for the B.G. (Form 15). Mr. Thos. Smith, clerk, Union Road, Leytonstone, N.E.

West Hartlepool.—September 14th. Steam, exhaust and other pipework, for the Corporation Electricity Department See "Official Notices" to-day.

CLOSED.

Admiralty.—The Admiralty has just placed their new contract for fuses with the British Electric Calibrated Fuse Co., Luton, Beds., who have been successful in obtaining the whole of the order for every size required.

Australia.—A large number of "Metroflam" arc lamps has been ordered from Messrs. Johnson & Phillips, Ltd., for the street lighting of Hobart, Tasmania.

Bacup.—We understand that an order for 416 loom motors for the new weaving shed of Messrs. Hoyle Bros., Ltd., Olive Mills, has been placed with the Schorch Electrical Co., London, which firm is also carrying out the necessary wiring for the power and lighting installation.

Burnley.—The Tramways Committee has ordered 10 top-covered cars at an estimated cost of £7,800. In connection with this the following tenders have been accepted:—

United Electric Car Co., Ltd.—10 top seat bogie car bodies and top covers, to be supplied in accordance with the Corporation specification, £535 each, and 10 pairs of Burnley maximum traction trucks, to be supplied in accordance with the Corporation specifications, £120 per pair.

British Thomson-Houston Co., Ltd.—10 electrical equipments (two G.E. 58 four-turn motors and other apparatus, £280 14s. each.

Messrs. Siemens Bros.' tender for 1,160 yards of cable of three sizes has been accepted, as also has the contract of the Tudor Accumulator Co. for the maintenance of the lighting battery at the electricity works for ten years, for £140.

Dundee.—Messrs. Nicoll & Co., Dundee, have secured the contract for installing the electric light in Stanley Parish Church.

France.—The French Post and Telegraph authorities in Paris have just given out some large contracts for bronze and copper wire. La Compagnie Française des Métaux, of Paris, are to supply 75 tons of bronze wire, 1½ mm. diameter, at 5,335 fr. per ton, and 200 tons of high-conductivity copper wire, 3 mm. diameter, at 2,650 fr. per ton; La Compagnie Générale d'Electricité, Paris, 75 tons of bronze wire, 1½ mm. diameter, at 3,340 fr. per ton; M. Grammont, of Pont-de-Cheruy, 200 tons of high-conductivity copper wire, 2½ mm. diameter, at 2,660 fr. per ton; La Société des Tréfileries du Havre, 800 tons ditto, at 2,670 fr.; La Société d'Electro-Métallurgie de Dives, 100 tons ditto, 3 mm. diameter, at 2,645 fr. per ton; La Compagnie Française du Bi-Metal, Paris, 100 tons ditto, 4 mm. diameter, at 2,635 fr. per ton; and La Société des Mines et Fonderies de Pont-Gibaud, 100 tons ditto, at 2,640 fr. per ton.

In connection with the adoption of electric traction on the Paris suburban system of the French State Railways, orders have just been given out for 400 electric motors. The Thomson-Houston Co. are to supply 100, the Westinghouse Co. 100, La Société des Ateliers de Jeumont 100, La Société Alsacienne de Constructions Mécaniques 50, and La Compagnie de l'Electricité de Criel 50.

Glasgow.—Some months ago the General Electric Co., Ltd., received an order from the Glasgow Corporation for over 200 magazine flame arc lamps, to be used for street lighting in the city; the Corporation has now placed a further order with the company for 225 of these lamps, all of which are to be used in place of open-type lamps.

Messrs. Johnson & Phillips, Ltd, have received a further order from the Glasgow Corporation for 400 of their 130-hour non-interval "Metroflam" magazine flame lamps, this being the third order for these lamps received from the Corporation during the past year.

Halifax.—The Tramways Committee has accepted the following tenders:—

Brush Electrical Engineering Co., Loughborough.—Six tramway car bodies, with top covers, £2,840.

Siemens Bros. Dynamo Works, Ltd, Stafford.—Six pairs of 40-H.P. motors, £1,032.

Manchester.—Referring to the contract for time switches mentioned in our last issue, we understand that, while our note was substantially correct so far as it went, it should be added that Messrs. Venner Time Switches, Ltd., received a large part of the order—the whole of the order, in fact, for such types as they make, with the exception of some small relay switches.

The T.C. has accepted the tender of the Lorain Steel Co., for special track work, at £10,231. This matter is referred to in our "Tramway Notes."

Peterborough.—The T.C. has accepted the tender of Messrs. Pritchetts & Gold for battery plates, &c., at £397, and for the maintenance of the battery for 10 years, at £50 per annum.

Salford.—The T.C. has accepted the tender of Messrs. E. M. Evans & Son, at £82, for installing electric light in a portion of the Town Hall. The tender of the Clifton and Kersley Coal Co., Ltd., has further been accepted for the supply of 1,300 tons of No. 4 washed steam nuts to the electricity department, at 12s. 11d. per ton.

FORTHCOMING EVENTS.

British Association.—Wednesday, September 4th to Wednesday, September 11th inclusive. Meeting at Dundee.

North-Eastern Counties Electrical Exhibition.—Saturday, September 7th to Saturday, September 28th inclusive. At the Exhibition Hall, St. Mary's Place, Newcastle-on-Tyne.

NOTES.

Electrolytic Hypochlorite.—The annual report for 1911 of the Medical Officer of Health for the Borough of Poplar (Dr. F. W. Alexander) gives full particulars of the production of electrolytic hypochlorite by the borough plant and of the purposes to which the fluid has been applied. The output for the year was 53,063 gallons, of an average strength of 5 grammes of available chlorine per litre, at a total cost for electricity and materials of £108 9s. The original installation was made some six years ago; and the total manufacture, of the strength named, now amounts to about 200,000 gallons, at a cost of less than £380 for current and materials. Including wages, rent of depôts, cost of bottles, distribution and all incidental charges, the average annual expenditure for five years amounts to £727. All the difficulties which have arisen in operation seem to have been effectually dealt with; and, in consequence of the recent extension of the borough electricity works, the plant has been removed to another site and re-erected on an enlarged scale to meet the increased demand for the disinfectant. The use of the fluid in the public baths has been continued; and the superintendents say that no slime now forms in the water, nor is any slime found on the bottoms of the baths when they are emptied; and there is, moreover, no offensive smell during cleansing the baths as was formerly the case. The solution is used in such quantity as will give one part of chlorine to two million parts of water.

In his "comments on adverse criticisms," Dr. Alexander anticipates that the cost of chlorine manufactured in other ways will be worked out to show that the Poplar process is extravagant; but it is not probable that such an objection will be raised by anyone who has had experience of the difference between working out results on paper and practical production. Whilst the price of bleaching powder remains at its present figure, it would appear to offer a cheaper means of producing chlorine than the electrolytic process; but, as the report indicates, when rapid depreciation, greater expenditure for labour—with the necessary skilled supervision—and the disposal of the residual lime-sludges and other inseparable disadvantages are taken into account, it is not likely that there would be any appreciable saving of cost, and quite possibly there might be an increase. The fluid prepared at Poplar is a solution of sodic and magnesic hypochlorites, which is not poisonous nor caustic, and possesses a much higher degree of stability than sodic hypochlorite alone. During the year 1,626 rooms and a total of 41,143 various articles, a considerable proportion being bed and bedding, were disinfected with the hypochlorite solution, which has entirely displaced carbolic acid in the Corporation services, and is supplied without charge to the managers of the sick asylums and to the Boards of Guardians in unlimited quantity. The Admiralty has recently installed at Osborne a plant similar to that put down by the War Office for the Victoria Hospital at Netley, which is on the Hermite system, and is capable of electrolysing 500 gallons of seawater per hour.

Municipal electrical engineers might well give this matter some attention.

The Zurich Electrical Bank Report.—The customary survey contained in the report for 1911-12 of the Zurich Bank for Electrical Enterprises points out that the demand for electrical energy is constantly increasing, and states that notwithstanding the Italo-Turkish war and the great strikes which have brought about a rise in the price of coal and shipping freight rates, most of the electrical undertakings which are closely associated with the bank, have made progress. Apart from the growing use of electricity for cooking and heating purposes, technical improvements have now rendered it profitable to employ electrical working in large industrial establishments. The use of current in agricultural operations is, unfortunately, often opposed by local government measures which do not conduce to the economic success of the installations. As far as the erection of overland central stations is concerned, the report gives a warning against the construction of stations in thinly-populated districts unless it is simultaneously possible to secure a connection with large works which serve for the supply of industrial localities. Dealing with the transformation of main lines to electric traction, it is mentioned that progress is taking place in Germany, Italy and Sweden, whilst the Swiss Federal State Railway authorities have adopted preparatory measures for the introduction of electrical working. The Rhatian and Lotschberg railways are also equipping their new lines with electricity, a system which has already proved its value in the case of individual Swiss railways of average importance. In contra-distinction to Germany and Italy, Switzerland seems disposed to produce the requisite power in its own works, whilst those nations which have had experience for some time, are increasingly obtaining their supplies of power from private undertakings, because the latter are able to furnish it cheaper by reason of the greater utilisation of their works, as they also serve for other purposes. The report, in referring to the extraction of atmospheric nitrogen, states that the industry has made considerable progress, and expresses the opinion that within a certain time European agriculturists will be much less dependent upon the nitrate deposits of Chile than is the case at the present moment.

Telephone Transmitter as Speed Indicator.—An original use is made of the telephone transmitter in connection with four direct-current motors driving water pumps for heating and water supply in the general office building of the Fort Wayne Electric Works. The motors are controlled from a general switchboard remotely situated, and it was desirable that the engineer in charge at the switchboard should have some way of knowing whether or not the motors were working properly, without going all over the building to the location of each one to find out. To accomplish this, each of the motors was provided with a telephone transmitter, the mouthpiece being placed quite close to the commutator of the machine; each transmitter had its individual telephone circuit terminating in a plug receptacle at the switchboard. When the engineer wishes to place a motor in service or adjust the speed, he plugs a telephone receiver into the terminating receptacle on the board and is able to tell if it is operating properly by the pitch of the humming sound of the motor, the pitch of the sound becoming higher as the speed of the motor is increased. Every motor used in connection with the water, heating and ventilating systems in this modern office building is equipped with a telephone transmitter. By this method the speed of the large exhaust fan motor fixed on the roof of the five-story building is quite as easily noted and controlled as is that of those which operate the pumps in the basement. In fact, the experienced engineer can control the speed of any of the motors as accurately and as easily as if the dial of a mechanical speed indicator were registering the speed directly before his eyes.

Annual Outings.—On Saturday, 24th ult., the annual outing of the staff of the Urban Electric Supply Co., Ltd., Carn Brea Station, took place. This year the venue was Newquay, where the morning was spent in sight-seeing. After lunch had been partaken of, the cricket team fulfilled their fixture with Newquay, and although the latter had the assistance of Mr. H. C. Mason, brother to the famous Kent player Mr. J. R. Mason, as well as the brothers O'Callaghan of Cambridge University, the U.E.'s were only defeated by 7 runs.

On Saturday last the annual outing of the employés of Messrs. A. W. Penrose & Co., Ltd., took place. The party, numbering close upon 100, journeyed by train to Chertsey, arriving about 11 o'clock. In the morning a football match was arranged and held in the grounds of the Cricketers' Hotel. After dinner, toasts to "The King" and "A. W. Penrose & Co., Ltd.," were honoured, and Mr. Gamble (who occupied the chair in the absence of Mr. A. W. Penrose), speaking of the firm, warmly alluded to the fine progress of the electrical and lift departments. In the afternoon the whole

party had a pleasant trip up the river, returning in time for tea The weather was beautifully fine, and helped to make the outing one of the best in the history of the firm.

Diesel-Electric Ship for Canada.—There is building at Wallsend-on-Tyne for the Montreal Transportation Co., a vessel for Canadian canal work which will have a D.W. capacity of 2,400 tons gross on a draft of 14 ft. The machinery consists of two 300-H.P. high-speed Diesel engines each with its own alternating-current generator and exciter. On the propeller shaft just ahead of the thrust block, there will be fitted a special compound wound squirrel-cage induction motor, turning the usual form of lake propeller at about 80 R.P.M., as compared with the 400 R.P.M. of the Diesel engines. A simple arrangement of switches enables the movements of slowing or reversing to be effected much more speedily and accurately than with a direct Diesel engine drive. The electrical equipment is on the Mavor system.

Educational.—The new course at the Crystal Palace School of Practical Engineering commences on September 11th.

The new session at the East London College will shortly commence. See "Official Notices" to-day.

Particulars are given in our advertisement pages to-day of the courses provided at the Northampton Polytechnic Institute.

Appointments Vacant.—BIRMINGHAM.—Shift engineer (£150 to £250 per annum). ERITH.—Switchboard attendant (20s. to 25s.). YORK.—Engineer to take charge of the installation department (£120 per annum). CIVIL SERVICE COMMISSION.—Assistant engineer, Engineer-in-Chief's Department, General Post Office. NORTH METROPOLITAN E.P.S. Co.—Power house shift engineer (£12 per mensem). See "Official Notices" to-day.

"Cable Discounts"—Correction.—The author informs us that an unfortunate error occurred in the last formula ("Non-Association"—pence per yard) on p. 323. It should read: "Add half the list price to a half of that, divide by 10, and subtract one-fiftieth of the result." The corresponding formula should read:—

$$D \text{ per yard} = \tfrac{1}{10}(L/2 + L/4) - \tfrac{1}{500}(L/2 + L/4).$$

Institution Notes.—INSTITUTE OF METALS. — The autumn meeting will be held in London on September 25th and 26th at the Institution of Electrical Engineers, and the programme has now been issued. Amongst the papers to be read are the following:—

Prof. F. Carnevali, Ph.D., on "Autogenous Welding by means of Oxygen and Acetylene of Copper and its principal Alloys, and of Aluminium."

Prof. A. K. Huntington, Assoc.R.S.M., on "The Effect of Temperatures Higher than Atmospheric on Tensile Tests of Copper and its Alloys."

F. Johnson, M.Sc., on "The Influence of Impurities in 'Tough-Pitch' Copper, With Chief Reference to Antimony."

E. F. Law, Assoc.R.S.M., on "The Influence of Oxygen on the Properties of Metals and Alloys."

Alexander E. Tucker, F.I.C., on "The Joining of Metals."

Prof. T. Turner, M.Sc., on "Oxygen in Brass."

Visits will be paid to the works of Messrs. Fraser & Chalmers, Ltd., Erith, the National Physical Laboratory, Teddington, Woolwich Arsenal, and the Brooklands Motor Race Course and Aviation Ground.

A special Council meeting will be held in London on September 10th, for the purpose of considering applications for membership of the Institute. All applicants for membership whose forms are in the Secretary's hands before noon on September 10th will be entitled to take part in the proceedings at the London Meeting. The Secretary is Mr. G. Shaw Scott, Caxton House, S.W.

INSTITUTION OF ELECTRICAL ENGINEERS (STUDENTS' SECTION). —At the meeting held on August 28th, Mr. J. C. Rennie was elected chairman for the coming session, Mr. D. Betts, vice-chairman, Mr. J. Mould, hon. secretary, and Mr. G. W. P. Page, hon. assistant secretary, 24, The Ridgeway, Enfield.

The British Association at Dundee.—Our representative at Dundee informs us that the proceedings opened with every prospect of a very successful meeting. The arrangements made locally are such that even the high record for hospitality attained by the citizens on the former occasion is likely to be surpassed, and the attendance will be well over 2,000, including an unusually large proportion of distinguished visitors from abroad. The programme of work before the various Sections is varied and interesting, and the meeting bids fair to be well above the average in the matter of the "advancement of science." The accommodation available has been taxed to the utmost, but with the aid of a large passenger steamer moored to the Quay the difficulty has been overcome. The handbook of Dundee and district prepared by the local committee forms a valuable work of interest both to visitors and to residents. Social entertainments have been organised on a scale of lavish hospitality, and include this time a ball. After the presidential address on Wednesday, a gift of £10,000 was presented to the Association by Mr. J. K. Caird, of Dundee.

London Tube Railway Collision.—As we go to press we learn that a collision occurred on the Piccadilly Tube Railway on Wednesday night, resulting in injuries to 15 people. This is the first collision that has happened on a London tube railway, and it is surmised that it is due to a fault in the automatic signalling arrangements.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials. — MR. W. CHURCHYED, station engineer at the Bridlington Corporation electricity works has resigned.

We regret to learn that MR. A. A. DAY, borough electrical engineer of Bolton, was suddenly taken ill on Saturday last while proceeding to Scotland for a holiday. It appears that Mr. Day had only travelled as far as Chorley when he had to be removed from the train and conveyed back to Bolton in an ambulance. He is understood to be recovering.

MR. G. W. ESSEX has resigned his position with the Cleveland and Durham Electric Power, Ltd., having been appointed assistant mains engineer to the Corporation of Sunderland.

MR. L. S. CARR, of the staff of the British Thomson-Houston Co., Ltd., of Rugby, has been appointed by the Birmingham Electricity Committee, at a salary of £400 a year, as constructional engineer for the erection of the electric power station at Hechells. The salary is to advance to £500.

MR. CECIL D. FALCKE was on Friday last presented with a handsome 400-day clock, by the staff of the Stratford-on-Avon Electricity Co., as a token of respect and esteem on the occasion of his retirement. Addressing the staff, Mr. Falcke expressed his thanks for the magnificent present they had given him, and hoped that they would give every assistance they could to his successor.

Tramway Officials.—MR. FRANK BUTLER, chief assistant to the manager of the Salford Corporation Tramways, has this week been appointed tramways traffic manager to the Wigan Corporation. There were 42 applicants for the post.

General.—MR. G. H. VAUGHAN, an engineer of the British Post Office, has been loaned to the Government of the Argentine Republic for a period of six months, in order to investigate and report upon the working of the telegraph system of that country.

The marriage took place at Denbigh, on August 27th, of MR. CHARLES DAWSON, electrical engineer at the Bettisfield Colliery, Bagillt, son of Mr. S. Dawson, of Mansfield, and Miss Ada Jones, daughter of Rev. Peter Jones, of Llys Meddyg, Denbigh.

The marriage took place at Barnstaple last week of MR. JOSEPH ROGERSON GANDY, electrical engineer, of Newcastle-under-Lyme, and Miss Ethel M. Grant, eldest daughter of Mr. E. W. Grant, of Barnstaple.

MR. H. E. M. KENSIT, who during the past four years has been occupied in investigating and reporting on various undertakings and projects in Canada and the United States for Messrs. Smith, Kerry & Chace, of Toronto, has now received an appointment with the Water Power Branch of the Department of the Interior, Ottawa.

On August 27th, at Llanddarog, Carmarthenshire, the marriage took place of MR. N. D. BLAGDON PHILLIPS, of Messrs. Siemens Brothers' railway signalling staff, and Miss Catherine T. Gabe, of Ammanford.

MR. WILLIAM H. LOWTH, of Underwood (Manchester), Ltd., has accepted an appointment with Messrs. Carney & Pearn, Ltd., of Manchester, as manager of the supplies department.

MR. J. F. WATTS is leaving Messrs. Siemens Bros. Dynamo Works, Ltd., after nine years' service, to take up a position with the Electrical Apparatus Co., Ltd.

NEW COMPANIES REGISTERED.

H. W. Smith & Co., Ltd. (123,953).—This company was registered on August 26th, with a capital of £5,000 in £1 shares, to carry on the business of electrical wire and cable manufacturers, carried on at Lydbrook, Glos., by H. W. Smith and F. W. T. Brain as "H. W. Smith & Co." The subscribers (with one share each) are:—H. W. Smith, The Beeches, Lydbrook, Glos., wire manufacturer; F. W. T. Brain, Huntnorth, Stoke Bishop, Bristol, colliery proprietor. Private company. The first directors are H. W. Smith and F. W. T. Brain. Solicitors: David Johnstone & Co., 31A, Corn Street, Bristol. Registered by Jordan & Sons, Ltd., 116-17, Chancery Lane, W.C.

Electrical Improvements, Ltd. (123,950).—This company was registered on August 23rd, with a capital of £5,000 in £1 shares, to carry on the business of generators, storers, sellers and suppliers of electrical or other energy for motive power, light, heat or other purpose, and gas and water in any part of the world, electrical, mechanical and chemical engineers and contractors, &c. The subscribers (with one share each) are:—L. H. Booth, Milburn House, Newcastle-on-Tyne, solicitor; J. W. Miller, Milburn House, Newcastle-on-Tyne, chartered accountant. Private company. The first directors, to number not more than four, are to be appointed by the subscribers; qualification, one share; remuneration as fixed by the company. Solicitor, L. H. Booth, Milburn House, Newcastle-on-Tyne.

Turbine Gears, Ltd. (124,000).—This company was registered on August 28th, with a capital of £5,080 in £1 shares, to carry on the business of manufacturers and sellers of gear-cutting machines, gear cutters, founders, mechanical and electrical engineers, tool makers, manufacturers of and dealers in machinery implements, rolling stock and hardware of all kinds, &c., and to adopt an agreement with J. Ogden. The subscribers (with one share each) are:—F. Tinker, Thornlee, 80, Lodge Lane, Hyde, boiler maker; J. Ogden, 192, Mottrom Road, Hyde, engineer. Private company. The number of directors is not to be less than three or more than seven, the subscribers are to appoint the first; qualification, £50; remuneration as fixed by the company. Solicitor: T. G. Russell, 78, King Street, Manchester. Registered office, Daisyfield House, Newton Moor, Hyde, Cheshire.

Transvaal Mica Co., Ltd. (123,940).—This company was registered on August 24th, with a capital of £80,000 in £1 shares, to carry on the business of miners, prospectors, explorers, metallurgists, refiners of, and dealers in, and preparers for market of ores, metals and mineral substances, &c., to acquire any mines, mining rights, and metalliferous land in the Transvaal or elsewhere, and to adopt an agreement with S. Munn. The subscribers (with one share each) are:—A. C. Drayton, 56, Moorgate Street, E.C., merchant; S. Munn, 24, Palace Road, S.W., merchant; A. L. Smith, 94, Portsdown Road, W., secretary; J. Shaw, 29, Cephas Street, N.E., clerk; F. E. Ransom, 5, River Avenue, Palmer's Green, N., clerk; A. Bowen, 51, Danvers Street, Paulton Square, Chelsea, clerk; M. Verstaevel, 1, Coram Street, Russell Square, W.C., clerk. Minimum cash subscription £7. The number of directors is not to be less than two or more than seven; the first are not named; qualification, £100 shares or stock, remuneration, £100 each per annum (£150 for the chairman). Registered office, Cross Keys House, 56, Moorgate Street, E.C.

Creed, Bille & Co., Ltd. (124,986).—Registered August 28th, by Maddison, Stirling, Hunim & Davies, 33, Old Jewry, E.C., capital £100,000 in £1 shares, to carry on the business of telegraphic engineers, manufacturers of telegraph or telephone receivers, transmitters or other instruments, apparatus or machinery, erectors and maintainers of telegraphic or telephonic stations, &c., to acquire the business of Creed & Co., telegraphic engineers, of 156, St. Vincent Street, Glasgow, and 266, Selsdon Road, Croydon, and to adopt an agreement with F. G. Creed, W. A. Coulson, and H. Bille, trading as Creed & Co. The signatories (with one share each) are:—F. G. Creed, 266, Selsdon Road, Croydon, telegraph engineer: W. A. Coulson, 156, St. Vincent Street, Glasgow, electrical engineer; H. Bille, 266, Selsdon Road, Croydon, telegraph engineer. Private company. The first directors (to be not less than three or more than six) are F. G. Creed, W. A. Coulson and H. Bille; qualification, 500 shares; remuneration as fixed by the company. Registered office, 266, Selsdon Road, Croydon.

Road Indicator, Ltd. (123,998).—This company was registered on August 28th, with a capital of £5,750 in 5,000 preference shares of £1 each and 15,000 ordinary shares of 1s. each, to acquire any invention relating to automatic route indicators, in particular to acquire the patent and other rights referred to in an agreement with Don Victoriano Casajus y Chaubel and A. Vitry, and to carry on the business of manufacturers of machines or instruments for automatically indicating or registering speed, distance, description of roads or other information for use with motor-cars, cycles and vehicles of all kinds, mechanical and electrical engineers, surveyors, map makers, &c. The subscribers (with one share each) are:—H. O. White, Leith Villa, Long Ditton, Surrey, clerk; C. Jauralde, 28, Danvers Road, Hornsey, N., clerk. Private company. The number of directors is not to be less than two or more than five; the first are Don Victoriano Casajus y Chaubel, Senor Santiago Laborda y Lopez and G. C. Bingham. Registered office, 54, New Broad Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Madras Electric Supply Corporation, Ltd. (87,409).—A memorandum of satisfaction to the extent of £70,800 (being amount issued) on August 7th, 1912, of debentures dated December 12th, 1910, securing £200,000, by the issue to the holders thereof of debentures for a similar amount, secured by a trust deed dated August 7th, 1912, has been filed. Amended particulars of £200,000 debentures, created July 20th, 1910, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £70,800. The original particulars gave the amount of present issue as £100,000. Particulars of £200,000 debentures created August 7th, 1912, and secured by trust deed of even date, filed pursuant to same section, the amount of the present issue being £188,675. Property charged: The company's undertaking and property, present and future, including uncalled capital, certain licences granted by the Madras Government authorities, and the undertakings constituted thereby, with buildings, land and plant, &c., and all purchase moneys payable by local authorities, and 11,452 ordinary shares of £5 each in Madras Electric Tramways (1904), Ltd., and all future holdings in that company. Trustees: Law Debenture Corporation, Ltd., 41, Threadneedle Street, E.C.

Dargue, Griffiths & Co., Ltd. (48,858).—Particulars of £6,000 debentures, created February 17th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £2,760, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. A memorandum of satisfaction to the extent of £2,300 on July 18th, 1912, of debentures dated July 17th, 1909, securing £3,000, also notified.

British Empire Lighting and Construction Co., Ltd.—Mortgage dated August 16th, 1912, to secure £900, charged on certain land and premises, &c., in King's Cliffe, Northamptonshire. Holder: M. J. Johnson, Swineshead, near Boston, Lincolnshire.

Naylorgraph, Ltd.—Debenture dated August 14th, 1912, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: J. M. Hunt, Fairlawn, Park Road, Southborough, Kent.

Foreign and Colonial Lighting, Ltd. (99,020).—Charge on company's outstanding book debts, patents, rights and other property, dated August 14th, 1912, to secure £805 17s. 2d. Holder: A. B. Reckett, Kenmore, Highlands, St. Leonards-on-Sea.

Shawinigan Water and Power Co.—At a special general meeting of this company, held in Montreal, authority was taken by the directors to issue $5,000,000 Common stock from time to time, and in accordance therewith notice is being issued offering to shareholders of record on September 30th $1,000,000 of stock at 120 per cent.

Stewarts & Lloyds, Ltd.—The directors have declared interim dividends for the half-year to June 30th at the rate of 6 per cent. per annum on the preference shares and at the rate of 10 per cent. per annum on the preferred ordinary shares.

Globe Telegraph and Trust Co., Ltd.—The directors of this company have declared a dividend of 3s. on the preference and 2s. on the ordinary shares, for the quarter.—*Financier.*

CITY NOTES.

Aberdeen Suburban Tramways Co.

Mr. George J. Walker, the chairman, in moving the adoption of the report at the half-yearly meeting of shareholders, said the profits earned for the half-year amounted to £1,484, and that with this there was a balance of £3,614 at the credit of the profit and loss account. At the close of the half-year ending July 31st last there was standing at the credit of the renewal and depreciation account a sum of £8,000. If the shareholders approved of the directors' recommendation to carry £2,000 of the sum standing at the credit of profit and loss account to the credit of this account, it would then stand at £10,000. That, although a substantial sum, and equal to close on one-third of the subscribed capital of the undertaking, would require to be augmented from year to year. The policy the directors had pursued in setting aside a substantial sum annually to meet renewals and extraordinary repairs would be continued. The whole of the mortgages on the company's undertaking had now been repaid. In short, the company since its inception had been able to set aside £10,000 to reserve, and to clear off £8,000 of borrowed money. This, on the whole, was satisfactory. The directors proposed that a dividend at the rate of 2½ per cent. for the past year on the paid-up capital of the company should be declared. This would require £780, and after providing for directors' fees there would remain £791 to be carried to the next account. Ex-bailie McKenzie expressed the hope that the directors had in view the doubling of the line so as to give a better service, at any rate as far as Cults. The report was unanimously adopted.

South Metropolitan Electric Light and Power Co., Ltd.—The warrants for dividends, due August 31st, on the 7 per cent. cumulative first preference shares and 6 per cent. cumulative second preference shares, have been posted.

A French Carbon Works.—La Compagnie des Charbons Fabius Henrion is the name of a new company which has lately been formed in Paris, with a capital of £100,000, to acquire and carry on the arc-lamp carbon business of M. Fabius Henrion, at Nancy.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

Primitiva Gas Co. of Buenos Ayres, Ltd.—£200,000 4 per cent. debenture stock (1911) (special application).

Puebla Tramway, Light and Power Co.—$3,000,000 prior lien 5 per cent. 50-year gold bonds, in lieu of the scrip.

The Committee has ordered the undermentioned securities to be quoted in the Official List:—

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Further issue of £68,000 4½ per cent. Consolidated First Mortgage Debenture Stock.

Toronto Power Co., Ltd.—Further issue of £800,000 4½ per cent. Consolidated Guaranteed Debenture Stock.

"Z" Electric Lamp Manufacturing Co., Ltd.—A representative of the Electrical Review attended Orient House, New Broad Street, E.C., on Wednesday to report a meeting of the above company, announced to be held, but was refused admission on the ground that the company did not want any report of the proceedings taken.

Jandus Arc Lamp and Electric Co., Ltd.—The directors recommend the payment of a dividend for the year of 10 per cent. on the paid-up capital, the transfer of £1,000 to reserve fund, and the carrying forward of the balance of £3,408, subject to deduction of directors' remuneration.

STOCKS AND SHARES.

Tuesday Evening.

The feature of the past week in the Stock Exchange has been a remarkable boomlet in the stocks of the Underground Railways. Prices went up at a breathless rate. City and South London Ordinary led off, jumping up two points a day for three days in succession, but for the biggest rise Metropolitan holds the first place. The price reached 62, and at 59¾ is 4¾ up on balance; City and South London went over 40 and back to 39, still showing a jump of 4¼, and Districts at 42 showed a gain of 3½ after being 43.

Rumours as to fresh linking-up developments between the Metropolitan District and City and South London started the movement. The Stock Exchange market bears grew fidgety and climbed in. Buying orders came from the provincial exchanges, and, the market being "all one way," as the Stock Exchange says, quotations went up to what in some cases looked like fancy figures. Central London Ordinary, hanging back at the outset, went up 4 points last Monday, and the Deferred at the same time gained 3. The whole of the Home Railway market has been firm (with occasional reactions), on the expectations of better traffics, and, possibly, increased dividends at the end of the current half-year, but the

Underground Companies have another reason for buoyancy in the wet August of unhappy memory. While markets were depressed, this consideration was ignored, as we pointed out here; it needed merely a change of sentiment, however, to throw such a factor into immediate prominence, and this combined with the rumours to create the boomlet.

Central London Preferences are a point or so better, but otherwise the pre-Ordinary securities are no more than steady, the fresh fall in Consols giving the "money" stocks a somewhat dull appearance. East Londons were taken in hand and put up to 9⅛, the company's junior Debenture stocks also benefiting from the little excitement.

The London Tramways issues are so far unaffected. London United Preference show a decline of the market turn, and the Metropolitan sextet did not change. Nor was there any pronounced activity in the Underground Electric Railways issues. A loss of a point in the Incomes was the only alteration, though it seems likely enough that if the Underground strength is maintained, the shilling "A" shares, at all events, will participate in the bullishness.

English electricity supply issues are inclined to harden, though were it not for a few prices being quoted *ex* dividend, the list would present a very stolid appearance. City Lights Ordinary and Preference are both marked 10s. lower, the dividend deductions in their cases being 6s. each, so that the net result is practically a fall of 4s. in the Preference and a rise of 6s. in the Ordinary. Kensington shares at 7½ are ⅛ higher, recovering part of the dividend. Charing Cross moved up to 4¾. Another month ought to see this market waking up, as the closing-in of evenings directs attention to illumination shares, while the electric supply market may have reasons for firmness special to itself.

By the way, a foolish slip (which cannot by any stretch of imagination be debited to the convenient printer) in our last week's Notes referred to the coming County of London interim dividend. The distribution had been, of course, already announced, but the company makes a new departure this year by notifying payment of the dividend in September instead of August.

The feature in the Latin-Canadian group is a fresh upward movement in Rio Trams, the price of the Common gaining 4 points. This brought it up to 154, and Sao Paulos at 263½ are 4 higher. Dealings in the market now take place in the "assenting" shares of these companies.

The news from Mexico is still unsatisfactory, and the market in Mexican Railway stocks continues to be depressed. This, however, has had no effect upon the prices of Mexican traction descriptions—in fact, the tramway shares are 1 up at 129½. Montreal Light and Power shed 10 points upon a seller appearing who was thought to have a fair amount to dispose of. British Columbia Electric Deferred rose to 143½; the other changes in this department are mostly occasioned by *ex*-dividend notices.

The telegraph market has enjoyed a fresh sensation in a big rise in Marconis. From 4⅝ the price rose a sovereign nearly straight away, easing off afterwards to 5⅛, at which the substantial improvement of 10s. is shown. The Preference advanced in sympathy. Canadians, Americans, and Spanish have all recovered. A short circular has been issued by the parent company, reference being made to the manner in which competition from the Federal Wireless Telegraph Company is to be met. The price of the shares was run up in anticipation of the statement, and when it was published, the reaction took place.

The Anglo-American group is disposed to harden, and rises have been secured by Anglo "A" and "B" and by Direct United States shares. Eastern stocks, too, are better, and Globe Telegraph Preference at 13 are ¼ higher. A rush to buy West India and Panama shares hoisted the price to 3⅞, from which it eased off to 3 9/16, the idea being, of course, that the Americans are endeavouring to get complete control. Most of the South American Telephone issues are steady to firm, and in the revival of Egyptian securities Telephone of Egypt Debenture stock rose ¼. Business is quiet in National Telephone Deferred, the quotation maintaining its big rise of last week. Telegraph Constructions are 10s. higher.

Manufacturing Companies' stocks and shares are in steady demand, the principal rise being one of a sovereign in India-Rubber shares, which have improved to 11. Dick, Kerr Debenture is nearly par, and British Insulated Debenture shares show a small improvement. Babcocks regained their trifling decline. Rubber shares have fluctuated a good deal up and down, though on balance the tendency has been towards higher prices. Business in this market remains active, and on any set-back there is plenty of steady support.

Lima Light, Power and Tramways Co.—A dividend of 1¼ per cent. has been declared in Lima on the shares for the second quarter of the current year ended June 30th, 1912, payable, against Coupon No. 2, forthwith.

Brazilian Light and Power Deal.—At the request of numerous holders who have only recently had the circular of July 15th, 1912, brought to their knowledge, the board of the Brazilian Traction, Light and Power Co. have extended the time within which shares of the Rio de Janeiro Tramway, Light and Power Co., the Sao Paulo Tramway, Light and Power Co., and the Sao Paulo Electric Co., may be deposited for the purpose of exchange. Copies of the circular and the necessary forms for exchange may be obtained from the Bank of Scotland, London, the Caisse Générale de Reports et de Depôts, Brussels, and the Canadian Bank of Commerce, Toronto.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Route miles open. Inc.
Aberdeen	Aug. 28	3,366	+ 107	13	21,182	— 371	14·4	..
Ayr	„ 30	808	+ 44	15	7,057	+ 151	8	..
†Bath	„ 7	1,287	— 41	32	28,314	+ 1,558	..	..
†Birkenhead	..	..	..	..	..	..	..	..
Birmingham Corp.	„ 24	20,392	+3,374	21	221,697	+53,116	57·17	..
Blackburn	„ 28	2,274	— 132	22	26,996	+ 117	14·62	..
Blackpool Corp.	„ 29	6,560	+1,106	..	44,227	+ 5,447	11·87	..
Blackpool-Fleetw'd	„ 31	3,345	— 186	8	15,055	— 1,004	8	..
Bournemouth	„ 28	5,140	+ 351	21⅔	43,121	+ 930	21·95	..
†Bradford	„ 24	5,498	— 5	21	119,063	— 2,237	56	1·2
Brighton	Sept. 1	2,575	— 193	22	25,283	— 903	9·5	..
Bristol	Aug. 20	15,071	+ 442	..	240,819	+17,596	30·5	..
Brit. Elec. Trac. Co.								
Airdrie	„ 23	655	+ 194	34	9,999	+ 2,642	3·65	..
Barnsley	„ 23	486	— 7	„	5,955	— 302	..	..
Barrow	„ 23	960	+ 28	„	13,078	+ 2,819	5·37	..
Devonport	„ 23	1,071	— 144	„	18,327	+ 1,548	8·85	..
Gateshead	„ 23	2,166	— 33	„	35,011	— 215	11·25	..
Gravesend	„ 23	474	— 7	„	7,044	— 260	6·5	..
Greenock	„ 24	1,843	+ 61	„	27,332	+ 2,839	7·25	..
Hartlepool	„ 23	742	+ 45	„	9,061	— 178	6·72	..
Kidderminster	„ 23	279	— 23	„	4,147	+ 44	..	..
‡Leamington	„ 23	464	+ 20	„	6,413	+ 405	..	..
Merthyr	„ 23	437	— 14	„	6,726	— 405	2·9	..
Metropolitan	„ 23	16,706	—1,247	„	299,586	+ 1,968	22	..
Middleton	„ 23	467	— 332	„	11,455	— 979	8·5	..
Mid. Joint Com'tee	„ 23	6,984	+ 483	„	110,149	+ 5,055	..	..
Oldham—Ashton	„ 23	1,285	— 120	„	20,753	+ 1,291	9·13	..
Peterborough	„ 23	397	+ 11	„	4,675	+ 321	5·31	..
Potteries	„ 23	3,606	+ 99	„	63,624	+ 1,466	29	..
Rothesay	„ 23	1,256	— 20	„	8,268	+ 231	2·75	..
Southport	„ 23	778	— 91	„	10,377	— 243	8·17	..
S. Metropolitan	„ 23	1,984	— 223	„	29,118	— 660	..	..
Swansea	„ 23	2,532	— 25	„	39,027	+ 35	12·5	..
Tynemouth	„ 23	871	— 190	„	8,624	— 883	3·75	..
Weston-s-Mare	„ 23	798	— 207	„	5,110	— 965	3	..
‡Worcester	„ 23	692	+ 36	„	10,055	— 18	5·75	..
Wrexham	„ 23	243	+ 2	„	3,779	+ 345	..	..
Yorks. Wool. Dist.	„ 23	2,257	— 83	„	36,684	+ 914	17	..
Miscellaneous	„ 23	550	— 53	„	7,918	+ 104	..	..
Burnley	„ 31	3,054	+ 242	..	..	..	12·44	·8
Burton-on-Trent	Sept. 1	495	— 33	22	6,108	— 336	6·6	..
Bury	„ 1	2,563	— 83	22	29,242	— 729	22·5	..
Cardiff	Aug. 17	5,440	— 129	20	49,126	— 3,0.6	17·35	..
†Chatham and Dist.	„ 22	947	+ 34	24	28,927	— 98	14·98	..
Cork	„ 29	994	— 109	35	16,925	— 697	9·89	..
†Croydon	„ 16	1,656	— 196	20	37,510	— 885	11·6	·75
†Darlington	„ 10	238	— 4	19	4,204	+ 45	4·87	..
Darwen	„ 30	560	..	22	6,212	+ 143	4·36	..
†Dover	„ 21	369	+ 24	21	5,612	— 386	4·76	..
Dublin	„ 20	12,642	— 318	..	54,220	— 9,503	54·25	..
East Ham	„ 31	2,257	+ 116	22	23,686	— 317	7·87	..
†Exeter	..	..	..	..	..	..	..	..
Glasgow	„ 31	37,350	—1,100	..	241,942	— 2,202	98	..
Hastings	Sept. 2	3,064	— 85	..	..	— 2,048	19·3	..
Huddersfield	Aug. 31	4,083	+ 92	22	44,349	+ 514	29·6	·5
Hull	„ 31	5,963	+ 308	22	63,762	+ 293	13·5	—1
†Ilkeston	„ 28	126	— 1	22	2,360	— 634	..	..
Ipswich	„ 24	1,057	— 66	21	10,062	— 71	10·5	..
Kilmarnock	„ 31	325	+ 2	15	2,627	— 230	4·25	..
Lancashire United	„ 28	2,841	— 163	35	46,527	— 495	39	..
Leeds	„ 24	15,409	— 102	21	16 525	+ 5,035	112·7	..
Leicester	„ 31	5,262	+ 386	35	88,870	+ 2,740	20	..
Leith	„ 31	1,486	+ 20	15⅔	11,270	+ 91	3·72	..
Liverpool	„ 24	24,035	+6,043	33½	405,632	+18,183	117	1
‡L.C.C.	„ 21	78,300	—5,182	..	881,816	—31,757	142	..
London United	„ 31	12,932	—1,240	..	222,933	—11,310	..	..
Lowestoft	„ 31	946	— 96	48	9,658	— 621	8·5	..
Manchester	„ 31	32,854	+ 848	22	371,303	+12,566	105	..
Newcastle	„ 31	8,443	+ 66	..	96,324	+ 298	31·3	..
†Newport	„ 31	733	+ 38	22	15,634	— 732	14·50	..
Oldham	Sept. 1	4,396	+ 716	23	48,059	+ 2,797	23	..
Pontypridd	Aug. 24	841	+ 58	21	7,982	— 858	5·5	..
Portsmouth	„ 24	5,152	— 622	21	44,006	— 4,040	15·75	..
Preston	„ 28	1,620	— 47	22	18,604	+ 873	10	..
Rotherham	„ 28	1,529	+ 138	21½	15,644	+ 806	12	..
Salford	„ 26	9,593	— 270	21	107,842	+ 2,061	41	..
Sheffield	Sept. 3	13,381	+ 888	..	151,552	+ 4,764	40	..
Southampton	Aug. 28	2,765	— 37	21	28,172	+ 59	11	..
Southend-on-Sea	„ 28	2,503	+ 213	22	19,749	+ 2,152	7	..
South Shields	„ 31	1,359	+ 26	22	14,272	— 218	10·25	..
Tyneside	„ 28	1,036	— 311	9	4,892	— 853	11	..
Wallasey	„ 31	2,454	+ 141	21⅔	25,894	— 577	8·72	..
Walthamstow	„ 31	1,468	— 111	22	17,544	— 465	9	..
West Ham	„ 22	5,111	— 196	20½	55,545	— 1,975	16·45	1·2
Wolverhampton	„ 28	2,104	+ 163	23	22,441	+ 860	13·75	..
Cen. London Rly.	„ 31	8,727	+ 904	9	38,501	— 184	6·78	·46
City & S. Lon. Rly.	Sept. 1	5,787	— 210	9	25,677	— 1,617	7·26	..
Dublin-Lucan Rly.	Aug. 30	324	— 17	9	1,449	— 131	7	..
G.N. and City Rly.	„ 31	2,604	+ 37	9	12,002	+ 107	3·5	..
L'pool Overh'd Rly.	Sept. 1	3,322	+ 491	..	15,396	+ 1,616	6·6	..
Llandudno-Col. Bay	Aug. 30	1,521	+ 71	39½	12,855	+ 456	6·5	..
Lond. Elec. Ry. Co.	„ 31	28,000	+1,790	..	108,095	+ 3 890	21·25	..
Mersey Railway	„ 31	4 529	+1,203	9	18,144	+ 2,149	4·5	..
Metropolitan Rly.	Sept. 1	32,278	+ 916	9	149,957	+ 4,488	25·75	..
Met. District Rly.	Aug. 31	21,942	+2,145	..	106,820	+ 9,246	25	..
Anglo-Argentine	Sept. 2	96,573	+2,692	..	1,767,371	+63,813	..	..
§Auckland	Aug. 2	18 353	+ 2,154	5	21,858	+ 5,659	23·31	..
Bombay (B.E.T.)	„ 8	5,699	+ 128	31	92,669	+ 4,662	..	..
§Brisbane	..	..	..	..	..	..	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Aug. 31	7,889	+ 881	..	..	..	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	July	2,998	..	30	21,650	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	..
Madras	Aug. 31	1,779	+ 315	..	26,570	+ 3,002	13·5	·5
§Montevideo	Aug.	26,249	+2,234	10	290,107	+39,834	..	..
Perth (W.A.)	Aug. 30	3,589	+ 498	..	65,008	+ 9,253	29	..

* Compared with the corresponding period of 1911. † One week only.
‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Sep. 3rd.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	5½	5½	9⅜ — 10⅜	..	5 2 4
Do. 4½ % Pref.	10	4½	4½	8½ — 9½	..	4 12 4
Do. Second 6 % Pref. ..	10	6	6	10⅝ — 10⅞	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	98 —100	..	4 10 0
Brompton & Kensington, Ord...	5	10	10†	8¼ — 9	..	5 11 1
Do. 7 % Cum. Pref.	5	7	7	7⅝ — 8¼	..	4 6 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 —100	..	4 0 0
Charing Cross, West End & City	5	5	5	4⅜ — 5	+ ⅛	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	..	4 17 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4¼	..	5 6 0
Do. Do. 4 % Deb... ..	100	4	4	94 — 96	..	4 3 4
Chelsea, Ord.	5	5	5	4¾ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	7	8	16½ — 18½xd	+6/-	4 6 6
Do. 6 % Cum. Pref.	10	6	6	12 — 13⅜xd	+4/-	4 9 0
Do. 5 % Deb.	Stock	5	5	118 —122	..	4 2 0
Do. 4½ % Second Deb. ..	100	4½	4½	99 —102	..	4 8 3
County of London, Ord... ..	10	5	6	11⅜ — 11⅞	..	5 1 1
Do. 6 % Pref.	10	6	6	11⅞ — 12⅜	..	4 17 0
Do. 4½ % Deb.	Stock	4½	4½	106 —108	..	4 3 4
Do. 4½ % Second Deb. ..	Stock	4½	4½	100 —103	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	7/16 — 11/16	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3/8 — 3/4	..	Nil
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4⅜ — 5¼	..	5 14 3
Do. 5 % Cum. Pref.	5	5	5	4⅛ — 5¼	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	92 — 95	..	4 14 9
Hove	5	9	9	7⅜ — 8	..	5 12 6
Kensington & Knightsbridge, Ord	5	9	9	7½ — 7⅝	+ ⅛	5 16 2
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	3	2	2½	1⅜ — 1⅝	..	4 0 8
Do. 6 % Pref.	5	6	6	4½ — 5½xd	..	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	5	4	8⅜ — 9⅞	..	5 3 3
Do. 4½ % Cum. Pref... ..	5	4½	4½	4¼ — 4⅝	..	4 17 4
Do. 4½ % First Mort. Deb...	Stock	4½	4½	99 —102	..	4 8 3
Do. 3½ % Mort. Deb... ..	Stock	3½	3½	86 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	97½ — 99½	..	4 10 6
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4⅜ — 4⅞	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	101 —104	..	4 16 2
Notting Hill, 6 % Non-Cum. Pref.	10	..	6	10 — 11	..	5 9 1
Oxford	5	7½	7½	5⅞ — 6⅜	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10	8½ — 9	..	5 11 1
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	83 — 86	..	4 1 5
Smithfield Markets, Ord. ..	5	Nil	2	1⅜ — 1⅞	..	..
South London, Ord.	4	5	5	3 — 3½	..	5 14 3
Do. 5 % First Mort. Deb. ..	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref...	1	7	7	13/32 — 15/32xd	..	5 14 9
Do. 4½ % First Deb. Stock ..	100	4½	4½	97 —100	..	4 10 0
Urban, Ord...	£3	5	..	1/4 — 3/4	..	..
Do. 5 % Cum. Pref.	5	5	2	2½ — 3	..	3 6 8
Do. 4½ % First Mort. Deb...	100	4½	4½	86½ — 88½	..	5 1 8
Westminster, Ord.	5	10	10	8¼ — 9	..	5 11 1
Do. 4½ % Cum. Pref... ..	5	4½	4½	5 — 5⅜	..	4 3 0

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5½ — 5⅝xd	..	5 4 4
Calcutta, Ord.	5	8½	8½	7⅞ — 8	..	5 6 3
Do. 5 % Pref.	5	5	5	4 15/16 — 5 3/16xd	..	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	95½ — 97½	..	5 2 7
Canadian Gen. El. Com. ..	$100	7	7†	114 —119	..	5 17 8
Do. 7 % Pref.	$100	7	7	120 —124	..	5 13 0
Cordoba Lt., Power and T., Ord.	1	8	8†	13/16 — 15/16	..	3 4 0
Do. 5 % Deb.	100	5	..	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	92 — 94	..	6 7 8
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	81 — 84	..	5 19 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	97 — 99 xd	..	5 1 0
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/8 — 1/4	..	Nil
Do. 6 % Pref.	1	6	6	1 3/16 — 1 5/16	..	8 6 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 —106	..	4 14 4
Madras, Ord.	5	..	..	.. ..	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 8
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	89 — 91	..	5 10 0
Mexican Lt. & Power, Common	$100	4	4	96 — 99	..	4 0 10
Do. 7 % Cum. Pref.	$100	7	7	109 —112	..	6 5 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	96⅛ — 98½	..	5 1 6
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	87⅛ — 89½	..	5 11 9
Montreal, Lt., H. and Power ..	$100	7	8	232 —237	—10	3 7 6
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	39 — 42	..	11 18 2
River Plate, Ord.	Stock	10	10	240 —250	..	4 0 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	109 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	4 17 1
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital ..	$100	4	5†	151 —156	..	3 4 1
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107½ — 109½	— ½	4 11 4
Do. 4½ % Per. Deb.	Stock	4½	4½	104 —106	..	4 5 0
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	99½ — 101½	..	4 8 8
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref. ..	1	Nil	11¾d.	5/16 — 1 3/32	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105 xd	..	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4†	7⅛ — 7¾	..	5 3 3
Do. 5 % Deb. Red.	Stock	5	5	95⅞ — 97½	—1	5 2 7
American Telep. & Teleg., Cap.	$100	8	8†	147½ — 149½	—1½	5 7 0
Do. Collat. Trust	$1000	4	4	93⅜ — 95⅜	..	4 3 9
Anglo-American Telegraph ..	Stock	8½	8	67⅛ — 69⅛	..	5 7 11
Do. 6 % Pref.	Do.	6	6	113½ — 114½	..	5 5 0
Do. Def.	Do.	80/-	80/-	26⅜ — 26⅝	..	5 12 8
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104 xd	+2	4 16 2
Chili Telephone	5	7	..	7⅛ — 7¾	..	4 10 4
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	83½ — 85½	+ ½	4 13 7
Cuba Telegraph	10	6	6†	9⅜ — 10⅜	..	5 14 3
Do. 10 % Pref.	10	10	10	16⅜ — 17⅜	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	4†	3¼ — 3⅜	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	7 — 7⅜	..	6 9 0
Direct United States Cable ..	10	4½	5	7⅛ — 8	+ ⅛	6 5 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	5†	129 —132	+ ½	5 6 1
Do. 3½ % Pref. Stock.. ..	Do.	3½	3½	73 — 80	+ ½	4 7 6
Do. 4 % Mort. Deb.	Do.	4	4	99½ — 101½	..	3 18 10
Eastern Extension	10	7	5†	18 — 18½	..	5 3 8
Do. 4 % Deb.	Stock	4	4	98½ — 100½	..	3 19 7
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	97½ — 100½	..	3 19 7
Globe Telegraph and Trust ..	10	5⅞	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	12⅜ — 13½	+ ¼	4 10 7
Great Northern Telegraph ..	10	18	18	28¼ — 29¼	..	6 3 1
Indo-European Telegraph ..	25	18	5†	57 — 59	..	5 3 5
Mackay Companies Common ..	$100	5	5	90 — 94	..	5 6 5
Do. 4 % Cum. Pref.	$100	4	4	70 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	5	20	5 1/16 — 5 5/16	+ ⅛	3 17 0
Do. 7 % Cum. Partic. Pref.	1	16	17	4⅜ — 4⅝	+ ⅛	3 13 8
Monte Video Telephone, Ord. ..	1	6	6	1 3/32 — 1 5/32	..	5 6 8
Do. 5 % Pref.	1	5	5	1 5/32 — 1 7/32	..	5 6 8
National Telephone Def. ..	Stock	6	6	152½ — 154½	+ ½	..
New York Telep., 4½% Gen. Bnds.	100	4½	4½	100¾ — 101¾	+ ⅛	4 8 8
Oriental Telep. and Elec. ..	1	8	8	1 1/16 — 1 1/32	— 1/32	4 8 2
Do. 6 % Cum. Pref.	1	6	6	1 3/8 — 1 7/32	..	4 18 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	3 18 5
Reuter's	8	5	5†	10⅛ — 10⅝	..	3 15 9
Submarine Cables Trust	Cert.	6	6	127 —130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99½ — 101½	+ ½	4 8 8
United River Plate Telephone	5	8	8	7⅛ — 7½	..	5 6 8
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5½	..	4 10 11
West Coast of America	2½	2½	2½	1 13/32 — 1 15/32	..	3 18 5
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1½	⅓	3 7/16 — 3 11/16	+ 5/16	..
Do. 6 % Cum. 1st Pref. ..	10	6	6	10⅛ — 10⅜	..	5 11 7
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9⅞ — 10⅛	..	5 17 0
Do. 5 % Debs.	100	5	5	100⅛ — 102⅛	..	4 17 7
Western Telegraph, Ltd. ..	10	7	6†	13 — 13½	..	5 3 8
Do. 4 % Deb.	Stock	4	4	97 — 99	..	4 0 10
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	100 —103	..	4 7 5

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Sept. 3rd.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil		..	Nil
Do. 6 % Pref.	1	6	6		..	6 8 1
Do. 4½ % Deb.	100	4½	4½	78 — 88	..	5 8 5
Brit. Elec. Trac., 6 % Pref.	100	..	..	11 — 13	..	..
Do. Do. Deferred	100	..	..	6 — 8	..	..
Do. Do. 6 % Cum. Pr'f.	100	..	6	89 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	..	..	37 — 40	..	..
Do. 5 % Perp. Deb.	100	5	5	98 —101	..	4 19 0
Do. 4½ % 2nd Deb.	100	4½	4½	80 — 84	..	5 7 2
Central London Railway, Ord.	100	8	8	77 — 79	+3	3 16 0
Do. Pref.	100	4	4	82 — 84	+2	4 15 3
Do. Def.	100	2	2	77 — 79	+3	2 10 8
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
City & South London, Ord.	100	1½	1½	98½— 99½	+1½	3 18 6
Do. 5 % Pref., 1891	100	5	5	106 —108	..	4 12 7
Do. Do. 1896	100	5	5	103 —105	+1	4 15 3
Do. Do. 1901	100	5	5	103 —105	+1	4 15 3
Do. Do. 1908	100	5	5	102 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
Dublin United Trams, 6 % Pref.	10	6	6	10½— 11½	..	5 2 2
Great Northern & City, Pr'f. Ord	10	Nil	..	1 — 2	..	Nil
Hastings Trams, 6 % Pref.	1	Nil	6	—	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	71 — 76	..	5 18 5
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2 — 3	..	4 11 0
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb.	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	95 — 97	+1	4 2 6
London United Trams, 5 % Pref.	10	Nil	..	4 — 5	—	..
Do. 4 % Deb.	100	4	4	72 — 76	..	5 5 3

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Sept. 3rd.	Rise + or Fall —	Present Yield p.c. £ s. d.
Metropolitan Railway Consol.	100	1⅞	1⅞	59½ — 60	+4½	2 14 2
Do. Surplus Lands	100	2⅛	2⅛	64 — 66	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0 6
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord.	100	Nil	Nil	41⅜— 42½	+8½	Nil
Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	99 —101	..	3 19 3
Do. 4½ % First Pref.	100	3½	4½	89 — 91	..	4 19 0
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 11 0
Metropolitan Elec. Trams, Ord.	1	5½	6	1 — 1⅛	..	5 6 8
Do. Def.	1	Nil	..	—	..	Nil
Do. 5 % Pref.	1	5	5	—	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % Deb.	100	5	5	99 —102	..	4 19 0
Potteries, Ord.	1	2	..	—	..	..
Do. 5 % Pref.	1	5	5	—	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	—	..	7 7 8
Do. 4 % Deb.	100	4	4	70 — 75	..	5 6 8
Underground Elec. Railways	10	..	..	4 — 4¼	..	Nil
Do. "A"	1/-	..	..	—	..	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1	1½†	89 — 91	..	..
Yorkshire (West Riding), Ord.	5	Nil	..	—	..	Nil
Do. 6 % Pref.	5	Nil	3	2¾ — 3⅜	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5⅛	5⅛ — 5⅜	..	5 2 4
Do. 2nd Pref.	5	5	5⅛	4⅛— 5⅛	..	5 6 0
Do. 4 % Deb.	100	4	4	93½— 95	..	4 4 3
Do. 4½ % Deb.	100	4½	4½	100 —102	+ ½	4 8 3
Do. 5 % Deb.	100	5	5	101 —103	..	4 17 1
Auckland Trams, 5 % Deb.	100	5	5	103 —105	+1	4 15 3
Bombay Elec. S. & Trams, Pref.	10	6	6	11½— 12	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	97 — 99	..	4 10 11
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brisbane Trams Invt., Ord.	5	8	8	7 — 7⅛	..	5 6 8
Do. 5 % Pref.	5	5	5	4⅞— 5⅛	..	4 15 8
Do. 4½ % Deb.	100	4½	4½	100½—103½	..	4 7 0
B. Columbia Elec. Rly., Def.	100	8	8†	141 —146	+1	5 9 7
Do. Pref. Ord.	100	6	6	119 —124	..	4 16 9
Do. 5 % Pref.	100	5	5	109 —112	..	4 9 1
Do. 4½ % 1st Mort. Deb.	40	4½	4½	99½—102½	..	4 7 10
Do. 4½ % Vancouver Deb.	100	4½	4½	103 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	102 —104	..	4 6 7
Calcutta Trams, Ord.	5	6	7	6⅛— 6⅝	..	5 5 8
Do. 5 % Pref.	5	5	5	4⅛— 5⅛	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
Cape Electric Trams	1	Nil	2½†	—	..	..
City Buenos Aires Trams (1904)	5	5	5	5⅛— 5⅜	..	4 6 11
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 — 99	..	5 1 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	—	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	5	3	35 — 43	— ½	6 19 6

La Plata Elec. Trms, Ord.	1	..	..	—	..	..
Do. Pref.	1	6	6	— 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	5½	6	1 — 1⅛	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb.	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb.	100	5	5	90 — 93	..	5 7 6
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½—102½	..	4 17 7
Mexico Trams Com.	$100	7	7	128 —131	+1	5 6 10
Do. Gen. Con. 5 % Bonds	..	5	5	99½—101½ xd	..	4 18 6
Do. 6 % Bonds	100	6	6	102½—104½	..	5 14 10
Para Elec. Rlys. & Lt., Ord.	5	10	10	7⅛— 7⅛ xd	+ ⅛	6 9 10
Do. 6 % Pref.	5	6	6	4⅞— 5⅛ xd	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	100½—102½	..	4 17 6
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1⅜— 1⅜ xd	..	1 18 4
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5½— 5⅝	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 11 0
Rio de Janeiro Trams	$100	4½	5†	152 —154	+4	3 5 0
Do. 1st Mort. 5 % Bonds	..	5	5	103 —104	..	4 16 2
Do. 5 % Mort. Bonds	100	5	5	100 —101	..	4 19 0
Sao Paulo Tram, Lt. and P.	$100	10	10†	261 —266	+4	3 15 2
Do. 5 % 1st Deb.	$500	5	5	104½—106½	— ½	4 14 0
Singapore Trams, 5 % Deb.	100	5	5	84 — 87	..	5 15 0
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video	5	6	7	5⅝— 6⅛	..	5 14 3
Do. 6 % Pref.	5	6	6	4⅞— 5⅛	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	101 —104	+1	4 16 2
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104 —106	..	4 4 11

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	—	..	8 0 0
Do. 6 % Pref.	1	9	6	—	..	7 7 8
Babcock & Wilcox	1	26	28	—	..	4 2 10
Do. Pref.	1	6	6	—	..	3 16 10
British Aluminium, Ord.	1	..	..	—	..	..
Do. 6 % Cum. Pref.	1	..	..	—	..	..
Do. 5 % Prior Lien Debs.	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	84 — 87	..	5 15 0
B.I. & Helsby Cables	5	10	10	7⅞— 8⅛	..	6 1 3
Do. Pref.	5	6	6	5⅞— 6⅛	..	4 14 1
Do. Deb.	100	4½	4½	101½—103½	+ ½	4 7 0
British Thomson-Houston, Deb.	100	4½	4½	94 — 96 xd	..	4 13 9
British Westinghouse, Pref.	8	Nil	..	—	..	Nil
Do. Deb.	100	4	4	58 — 61	..	6 11 2
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 3
Browett, Lindley, Ord.	1	Nil	..	2/- —3/-	..	Nil
Do. Pref.	1	Nil	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 —	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	50 — 55 xd	..	8 3 8
Do. 4½ % Second Deb.	100	4½	4½	35 — 40	..	11 5 0
Callender's Cable	5	15	10†	10½— 11	..	6 16 4
Do. Pref.	5	5	5	4⅝— 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	99 —101	..	4 9 1
Castner-Kellner	1	17½	20	31⅛— 31⅝	..	5 5 3
Do. Deb.	100	4½	4½	102 —105	..	4 5 9

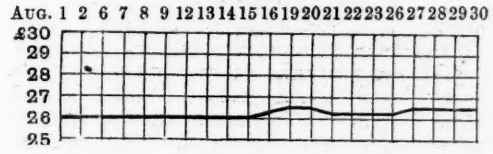
Crompton & Co.	8	Nil	Nil	—	..	Nil
Do. Deb.	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	5	—	..	5 14 3
Do. Pref.	1	6	6	1 — 1⅛	..	5 6 8
Do. Deb.	100	4½	4½	97 —100	+ 2	4 10 0
Edison & Swan, A, £8 paid	5	Nil	..	—	..	Nil
Do. fully paid	5	Nil	..	—	..	Nil
Do. 4 % Deb.	100	4	4	64 — 68	..	5 17 8
Do. 5 % Second Deb.	100	5	5	75 — 78	..	6 8 2
Electric Construction	2	2½	3⅜	— 1	..	7 10 0
Do. Pref.	2	2	2	1⅞— 2	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	7½ — 8	..	8 5 8
Do. Deb.	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	4 10 11
Do. Deb.	100	4	4	92 — 97	..	4 2 6
Henley's, Ord.	5	15	10†	12 — 12⅜ xd	..	5 17 8
Do. Pref.	5	4½	4½	4⅜— 5 xd	..	4 10 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
India-Rubber, G. & T.	10	..	..	10½— 11½	+1	..
Do. Pref.	10	5	5	9½— 10⅜	..	4 17 7
Telegraph Construction	12	20	10†	33½— 35½	+ ½	6 8 2
Do. Deb.	100	4	4	97 — 99	..	4 0 10
Willans & Robinson	1	Nil	..	—	..	Nil
Do. Pref.	5	Nil	..	— 1	..	Nil
Do. Deb.	100	4	4	58 — 60	..	6 13 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

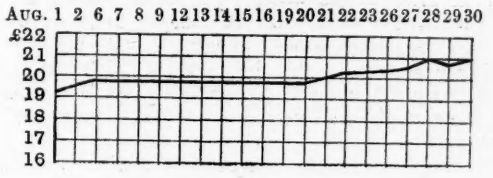
METAL MARKET.

Fluctuations in August.

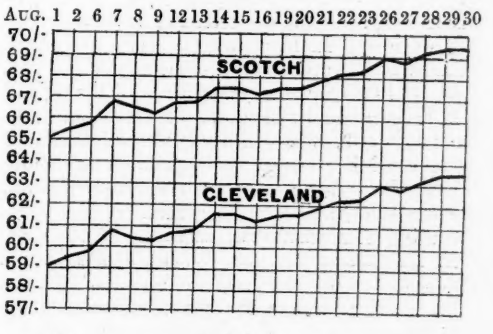
SPELTER (G.O.B's.).



LEAD (ENGLISH).



IRON.



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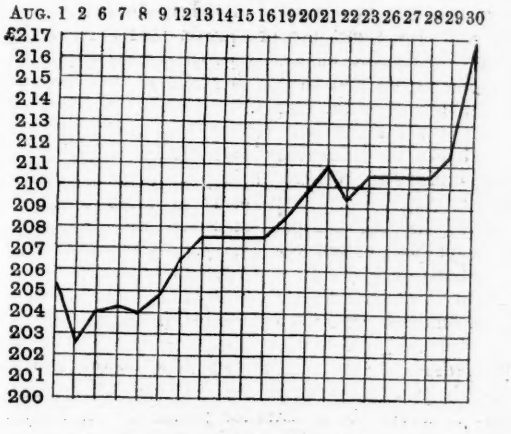
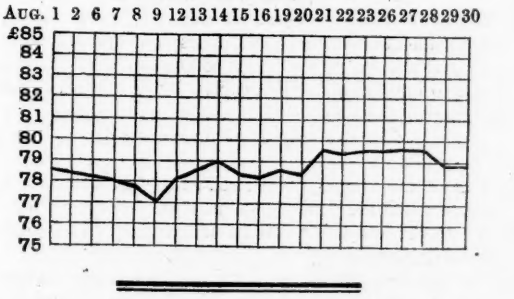


COPPER (G.M.B's.).



Hoylake Electricity Supply.—A L.G.B. inquiry was held on August 29th, relative to the U.D.C.'s application for power to borrow £1,300 for fitting a new boiler and pump, and making other improvements at the electricity generating works. The proceedings were formal, the Inspector observing that it was quite obvious that the extension was necessary.

COMPANY AND CONSUMER.

[FROM A LEGAL CONTRIBUTOR.]

(*Concluded from page* 337.)

11. *Who is Liable for Electricity Supplied?*—It next becomes important to consider who may be sued by the undertakers in the event of their being compelled to seek payment of their lawful charges by action at law.

The Electric Lighting Act, 1882, incorporates, by Sec. 12, Secs. 38—42 and Secs. 45 and 46 of the Gasworks Clauses Act, 1871, which relate to the recovery of gas and meter rents in order to ascertain the rights of a supply company to recover the price of electrical energy supplied; it is, therefore, necessary for us to refer to the incorporated sections of the Gasworks Act and the cases which have from time to time arisen thereunder. It is this unfortunate system of "legislation by reference" that has led to much of the difficulty which has been experienced in interpreting the Electric Lighting Acts.

The incorporated sections are to be construed, for the purpose of the Electric Lighting Act, 1882, as if "gas" meant "electricity," and as if "pipe" meant "electric line" and "works" meant works as defined by the Electric Lighting Act, 1882, and as if "the limits of the special Act" meant the area within which the undertakers are authorised to supply electricity under any licence, order or special Act.

It is provided by Sec. 21 of the Electric Lighting Act, 1882, that if any local authority, company, or person neglect to pay any charge for electricity, or any other sum due from them to the undertakers in respect of the supply of electricity to such local authority, company or person, the undertakers may cut off such supply, and for that purpose may cut or disconnect any electric line or other work through which electricity may be supplied, and may, until such charge or other sum, together with any expenses incurred by the undertakers in cutting off such supply of electricity as aforesaid are fully paid, but no longer, discontinue the supply of electricity to such local authority, company or person.

This power to disconnect is in addition to the right of the company to sue for the rent which is due. Thus it is provided by Sec. 41 of the Gasworks Act that whenever any person neglects to pay any rent or sum due and payable, the undertakers may recover the same with full costs of suit, in any court of competent jurisdiction; and the remedies of the undertakers under this enactment are in addition to, and not in substitution for, the recovery of such rent by other lawful means. Other lawful means include proceedings for the recovery of civil debts in a court of summary jurisdiction, as provided by the Summary Jurisdiction Act, 1879 (42 and 43 Vic., Cap. 49, Secs. 6, 35), which formulates the procedure under which penalties may be recovered.

The recovery of a judgment is sometimes an empty victory in cases where the defendant is unable to discharge his indebtedness by payment. In such circumstances the undertakers are compelled to go one step further. The judgment being recovered by what is technically known as a "civil proceeding," an order for commitment cannot be obtained until the debtor has been personally served with the judgment summons, and proof has been given to the Bench as to his means.

Change of occupancy, and the liability of an incoming tenant to pay the arrears accumulated by an outgoing one, have been specially provided for in the Acts. Thus it is provided by Sec. 39 of the Gasworks Clauses Act, 1871, which is incorporated, as we have seen, with the Electric Lighting Acts, that in case any consumer of electricity supplied by the undertakers leaves the premises where such electricity has been supplied to him without paying the electricity rent or meter rent due from him, the undertakers shall not be entitled to require from the next tenant of such premises the payment of the arrears left unpaid by the former tenant, unless such incoming tenant has undertaken with the former tenant to pay or exonerate him from the payment of such arrears.

This provision, which operates in protection of the consumer, exposes the supply company to a risk which can be overcome by the demand of security in accordance with the provisions of the Electric Lighting (Clauses) Act, which we

have already considered. Further, it only applies to cases where the relationship of landlord and tenant exists. Thus, in a case where a receiving order had been made against a debtor, the gas company cut off the supply of gas to his premises, and refused to re-connect until the arrears of gas rent due from him were paid. The Official Receiver paid the amount under protest, the debtor having been adjudged bankrupt. In an action by the Receiver to recover back the amount so paid, it was held that, as the debtor continued to be the occupier of the premises, there had been no change of occupation, and therefore there was no obligation upon the company to supply gas without payment of the arrears. The fact that the debtor continued in possession is the essence of the above decision.

In a much later case (in *re* Flack, *ex parte* Berry, 1900, 2 Q.B. 32), a debtor having been adjudicated bankrupt, his trustee took possession of the business premises, and found that the water rate was in arrear. The company declined to continue the supply until the arrears were paid, and cut off the water. It was decided that he was an "incoming tenant" within the meaning of the section which applies to the supply of electricity, and that he was entitled to recover back the amount overpaid.

By Sec. 18 of the Electric Lighting Act, 1909, the undertakers may refuse to supply electrical energy to any person whose payments for the supply of electrical energy are, for the time being, in arrear (not being the subject of a *bonâ fide* dispute), whether any such payments be due to the undertakers in respect of a supply to the premises in respect of which such supply is demanded or in respect of other premises.

Before removing, a consumer must give notice to the undertakers. Thus, by Sec. 17 of the same Act, 24 hours' notice in writing shall be given to the undertakers by every consumer before he quits any premises supplied with electrical energy by the undertakers, and, in default of such notice, the consumer so quitting shall be liable to pay to the undertakers the money accruing due in respect of such supply up to the next usual period for ascertaining the register of the meter on such premises, or the date from which any subsequent occupier of such premises may require the undertakers to supply electrical energy to such premises, whichever shall first occur.

Notice to the effect of this section shall be endorsed upon any demand note for charges for electrical energy.

12. *Time for Proceedings.*—Proceedings for the recovery of an electric lighting rent must, it is submitted, be commenced within six months from the time when the matter of it arose. This seems to follow from a consideration of Sec. II of the Summary Jurisdiction Act, 1848, which provides that in all cases where no time is specially limited, a complaint or information must be laid within six months. The section has been applied to a summons for arrears of water rate (East London Waterworks Co. *v.* Charles (1894) 2 Q.B. 730), and in the absence of authority it is presumed that the principle would also apply to arrears of electric lighting charges.

13. *Notice to Disconnect.*—Probably the most effective way of obtaining payment of arrears is to threaten to disconnect the house from the mains unless the debt is discharged. The following is a convenient form of statutory notice to disconnect :—

The Electric Supply Co.
(Address)

NOTICE TO DISCONNECT.

We hereby give you notice, under Sec. 21 of 53 and 54 Vic. Cap. 56, that unless the sum of £ is, within seven days from the date of service hereof, given as security for the payment of all moneys which are and may from time to time become due in respect of the supply of electric energy the company may discontinue such supply, and will take action to recover all moneys due.

14. *Alteration in the Price of Electricity.*—In many cases the price charged for electricity is much below the maximum which the undertakers are entitled to charge by their provisional order. When they desire to increase their price, notice must be given to consumers, the length of notice being usually decided by the nature of the agreement under which the current is supplied. Thus, in the case of a quarterly agreement, a quarterly notice would be considered sufficient. This question has arisen in relation to the supply of gas. In the Commercial Gas Co. *v.* the Mayor, &c., of Stepney (the *Times*, January 24th, 1901) the defendants were summoned by the plaintiffs, who desired to obtain payment of the sum of £917 8s. for gas supplied. It appeared that by the Commercial Gas Co.'s Act of 1875, Sec. 53, the company were allowed to raise the price of gas if the rate of dividend were reduced. The defendant Corporation paid less than ordinary consumers, and when the company raised the price to their ordinary consumers, the parish price was increased. It was contended on behalf of the defendants that, inasmuch as they were under a quarterly agreement with the gas company, they were entitled to notice of any alteration in the price. The magistrate, in giving his decision, said, "I have come to the conclusion that, under the agreement, the company have no right to raise the price of gas without reasonable notice. If they want to raise the price, then they ought to give the local authority reasonable notice, in order to put an end to the existing agreement. All the sections which have been quoted, when taken together, point to a special agreement as to the sum which the company were to charge to the local authority."

The foregoing remarks as to change in price must always be subject to the terms of any agreement between company and consumer. So long as the maximum price is not exceeded, it is competent for the company to charge what they like as long as no undue preference is shown.

15. *Remedies of the Consumer for Failure of Supply.*—Failure to supply electricity in accordance with the terms of the Provisional Order renders the company liable to penalties. Thus, it is provided by Sec. 30 of the Schedule to the Clauses Act, 1899, that whenever the undertakers make default in supplying energy to any owner or occupier of premises to whom they may be, and are, required to supply energy under the special order, they shall be liable in respect of each default to a penalty not exceeding 40s. for each day on which the default occurs. When the default is due to the insolvency of undertakers, the Board of Trade may, after due inquiry, revoke the special order (Sec. 63 *ib.*). Penalties inflicted upon undertakers under this section must in no case exceed in the aggregate, in respect of any defaults not being wilful defaults on the part of the undertakers, the sum of £50 for any one day. Further, no penalty is to be inflicted if the Court are of opinion that the default was caused "by inevitable accident, or *force majeure*, or was of so slight or unimportant a character as not materially to affect the value of the supply."

The penalties provided for by this section may be recovered, not only where there is a neglect or refusal to supply energy under such pressure as is prescribed, but also where there is a neglect or refusal to supply energy at all; consequently the section applies in a case where the company have improperly cut off the supply. (See Commercial Gas Co. *v.* Scott (1875) L.R. 10 Q.B. 400.)

As to what constitutes *force majeure*, it was held in the case of Sun Insurance Co. *v.* Dublin Corporation (*Electrician*, December 9th, 1899, page 240), that where a cable laid down proved defective, and the supply of energy thus broke down, the plea of inevitable accident could be successfully urged in answer to a claim for penalties. In Marylebone Vestry *v.* Metropolitan Electric Supply Co. (*Journal of Gas Lighting*, January 2nd, 1900), the defendant company were summoned for making default in supplying electrical energy to the workhouse and vestry premises on certain days. The company admitted the default, but contended that the same was due to inevitable accident caused by the great increase in the demand for electricity, which had exceeded their expectations. The case was adjourned for three months, and was not heard of again. In a subsequent case, however, the same company were fined at the suit of the London County Council for making default in the supply of electricity, to the houses of certain individuals. (*Ib.*, January 23rd, 1900, page 212.)

The penalties referred to in this section are incurred by improperly cutting off or discontinuing the supply of electricity. The question whether proceedings at law would avail the consumer either in addition to, or in substitution for, the recovery of a penalty provided by statute does not seem to have arisen in connection with the supply of electricity, although it has been frequently discussed in connec-

tion with the gas and water supply. The result of the decisions may be said to be that where a duty is cast by statute upon a company or person, and penalties are imposed for failure on the part of the company to perform that duty, the company are only liable to pay penalties (Atkinson *v.* Newcastle Waterworks Co., 2 Ex. D 441). Now, it is clear that, under the Electric Lighting Acts, 1882-1899, an electricity supply company is bound to furnish current "without favour or distinction to all persons within their district," and it is also clear that they become liable to penalties in case of refusal. Hence the jurisdiction of the civil Courts appears to be ousted.

In another case, Mr. Justice Wills said: "The principle applies that where a duty is created by Statute which affects the public as the public, the proper remedy, if the duty is not performed, is to indict the company, or institute the prescribed proceedings." (Clegg *v.* Earby Gas Co. (1896), 1 Q.B., 592.)

If the above view of the law is correct, a plaintiff claiming damages in any Court for breach of contract on the part of the company would run serious risk of a non-suit.

16. "*Power Companies*" *and Consumers.*—There were formerly no special public statutes to specify, in general terms, the relationship between power companies and their consumers. It should be observed, however, that the Electric Lighting Act, 1909, makes ample provision on this head (see Sec. 18 *infra.*), and that while all the private Acts incorporate the Electric Lighting Acts, 1882-1899, to a greater or less extent, those portions of the public Acts which relate to "price," &c., are for the most part replaced by special provisions in each private Act.

Electric lighting companies supply energy in comparatively small quantities to private consumers. Power companies are only allowed to distribute electricity *in bulk* either to electric light distributing companies or to manufacturers who require a supply of energy to drive their machinery. The power company is prohibited from supplying energy for lighting purposes except to manufacturers who also take a supply of electricity for the purposes of power.

17. *Conditions of Supply by Power Company.*—The power company is not only obliged to provide a sufficient supply of electricity to consumers, but must lay mains for the purpose when required to do so. Moreover, there is no limit to the distance through which the necessary mains may be required to be laid, as in the case of the supply of electricity supplied under an Electric Lighting Order. Hence any factory proprietor in the company's district may obtain a supply of energy. For the protection of the power company the following proviso is generally inserted:—"Provided that the company shall not, except as provided by this Act, be bound to give any supply to any such authorised undertakers, unless such authorised undertakers shall enter into a written contract to take the *whole* of the supply required by them for the purpose of their undertaking from the company." If an increased supply is required, the same can only be had after due notice.

The above condition was inserted in the Durham Electrical Supply Act, 1900 (Sec. 8). The Lancashire Electric Power Act, 1900, Sec. 42, after providing that local authorities and companies should be entitled to be supplied, contained a proviso that they should: "Enter into a contract with the company (if so required) to continue to receive and pay for a supply of energy for a period of at least seven years of such an amount that the payment to be made for the same shall not be less than £20 per cent. per annum of the outlay (excluding expenditure on generating plant and any electric line then laid) incurred by the company in making provision for such a supply.

As it would in many cases be very inconvenient for manufacturers to bind themselves to take their whole supply from one source, a clause is generally inserted binding the company to give a partial supply on terms to be fixed by an arbitrator appointed by the Board of Trade. Such terms are to be fixed with regard to:—

1. The period for which the users are prepared to bind themselves to take energy.

2. The amount of energy required and the hours when required.

3. The capital expenditure necessary; and

4. How far the capital expenditure may become unproductive.

18. *Provisions of Electric Lighting Act, 1909, as to Supply in Bulk.*—By Sec. 4 of the Act, the Board of Trade, unless they are of opinion that, by reason of the character or magnitude of the proposed undertaking, the matter ought to be dealt with by a Private Bill, may, by Provisional Order, authorise any local authority or company to supply electricity in bulk; provide for any supply so authorised being compulsory; and make such other provisions as appear to them necessary for adapting the Electric Lighting Acts to any case where a local authority or company are authorised to supply electricity in bulk, including the application to roads, railways and tramways along the route along which lines are authorised to be laid for the purpose of giving the supply in bulk, of the provisions of those Acts which authorise or enable the Board to authorise the breaking up of any road, railway, or tramway. If the Board refuse to grant a Provisional Order, under these powers on the ground that the matter ought to be dealt with by a private Bill, then, subject to the Standing Orders of Parliament, and subject to the provisions for giving of certain additional notices, the notices published and served for the purposes of the provisional order are to be held to have been published and served for the purposes of a private Bill applying for similar powers, and the application for the Provisional Order is to be treated as a petition for leave to bring in a private Bill.

ELECTRICITY SUPPLY IN SHEFFIELD.

(*Concluded from page* 326.)

Earthing.—The interconnection of the three-phase and two-phase systems at Neepsend makes it unsafe to earth the neutral of the three-phase star in the ordinary manner (for it would then be possible for the small turbo-sets to go to earth through the 5,000-KW. feeders—probably resulting in a burn-out; further, the generators, feeders and bus-bars will withstand 11,400 volts to earth on test but not on load).

A special earthing transformer is therefore used in conjunction with Ferranti Field earth current devices, as shown in fig. 5. The earthing transformer is of 355 KW. capacity

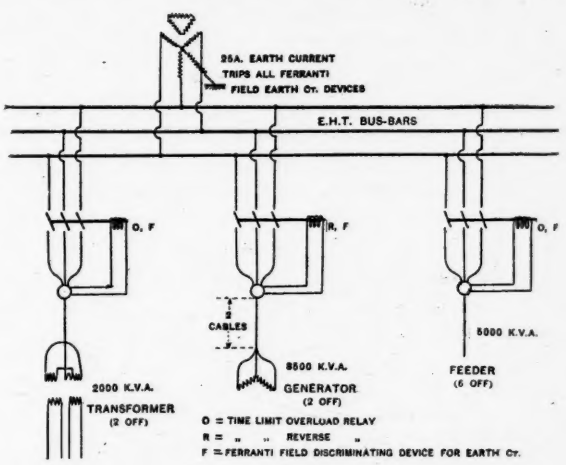


FIG. 5.

and is connected across the extra-high-tension bus-bars with the primary in star, and the secondary in delta connection It is thus ensured that the centre of the star shall normally be at earth potential. On the occurrence of a fault, the current flowing through the earth connection is limited by a series resistance to 25 amperes, and this current is sufficient to trip all the earth current devices, which operate on the main switches in parallel with the usual time-limit over-load and reverse current relays. The earthing device is connected directly and permanently to the bus-

bars; the feeder systems are *not* interconnected, and the transformer secondaries are *not* in parallel. The protective system is similar to the Merz-Price, but is for simple instead of for ring main installations: it is alternative to the L.C.C. (Greenwich) earthing device (see Electrical Review, Vol. 64, page 785 *et seq*).

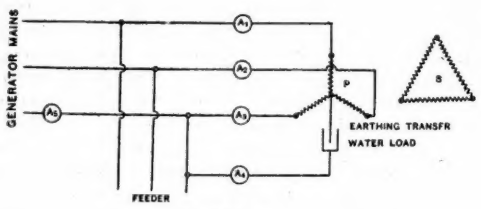


Fig. 6.

When tested through a water load, representing an earth on the feeder (fig. 6), it was found that the current distribution in the various branches of the earthing circuit was as follows: When $A_4 = 25$ amperes (sufficient to operate the Ferranti devices), $A_1 = A_2 = A_3 = 8{\cdot}33$ amperes and $A_5 = 16{\cdot}67$ amperes (out-of-balance current, flowing till the feeder is isolated).

Before passing from the plant to the supply conditions and results obtaining at Sheffield, attention must be called to the great improvement introduced by Mr. Fedden in the method of calling for tenders. Each contractor is instructed to tender *direct to the engineer* for such parts of the equipment as he is prepared to manufacture and supply. Cross tendering is thus prevented, and the task of preparing and analysing tenders is greatly simplified.

Though the field for electrical development is admirable, the electricity department has by no means an easy task to reap its harvest. Gas is available for lighting at 1s. 3d., and for power at 11d. per 1,000 cb. ft., and the average citizen of Sheffield is particularly hard-headed and must be absolutely convinced as to the economic possibilities of a given proposition before he will take it up. It is obviously difficult to show any *direct monetary* economy in electric lighting with gas at 1s. 3d. per 1,000 cb. ft., and it is quite typical of the district that a number of shopkeepers have installed electric lighting outside and in the windows of their shops, while adhering to gas burners inside and in their living quarters. The tacit compliment to electric lighting would be more appreciated if the consumer would so far establish the courage of his convictions as to follow them completely. He would have no cause for subsequent regret.

Over 600 new services have been connected since last year, and, to cater for shop and domestic loads, the Corporation has established an energetic canvassing department and a handsome showroom.

During the past year there has been in vogue a 50 per cent. discount in the lighting tariff (nominal price 4d. per unit) for consumers who guarantee an average daily use of their lamps for 4½ hours. Since the application of this rebate the revenue has rapidly increased.

Heating and cooking supply is at 1d. per unit, and there are at present about 1,000 electric radiators and convectors in use, but very little has yet been achieved in the cooking field.

Fully 65 per cent. of the total sales are now utilised for power purposes, the rapid development in the actual and relative power sales being clearly shown by the following figures:—

Year ending March.	Units sold for—			Motors.	
	Lighting.	Power.	Heating.	Number.	Horse-power.
1910 ...	3,327,137	6,776,361	214,435	1,421	14,005
1911 ...	3,421,409	10,580,847	251,945	1,680	17,086
1912 ...	3,689,875	12,777,648	295,401	1,914	20,030

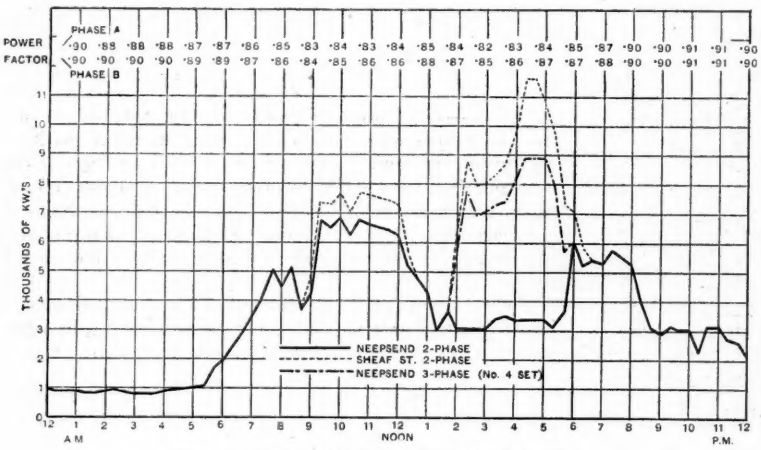


Fig. 7.—Typical January Day Load Curve.

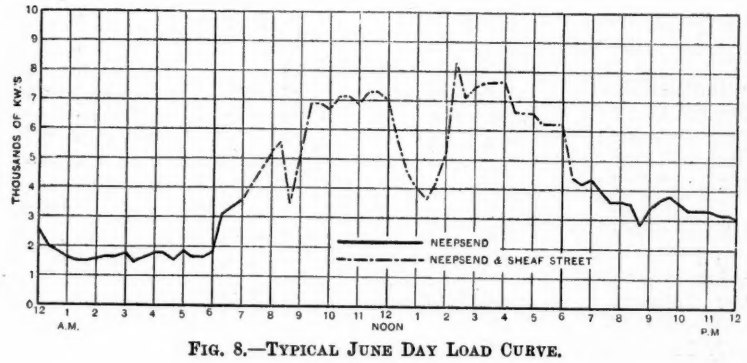


Fig. 8.—Typical June Day Load Curve.

As one result of the coal strike, the Corporation gained a number of valuable power consumers, and under the favourable scale of power tariffs in vogue (ranging from 1d. per unit for consumers taking 5,000 units per annum, to 0·6d. for consumers taking 750,000 units per annum), the power demand is increasing at an extraordinary rate, with which the department is able to cope owing to its early extensions, large stand-by capacity and excellent system of distribution.

Load Curves; Load Factor; Power Factor.—Many of the individual demands supplied by the Sheffield undertaking are very severe in nature. Thus, the steel furnaces in a certain works throw a load of 600-1,000 KW. on and off the mains four or five times a minute during their operation, and a certain rolling mill is liable to take 600-800 KW. suddenly at any time of day or night. Thanks to the flexibility and overload capacity of the generators and the smart action of the Tirrill regulators employed, there is no difficulty in coping with these and similar load variations, but the Department is considering the advisability of introducing tariffs which shall take into account the load and power factor of the demand.

Typical load curves showing the variation in demand during a day in January, and one in June, are reproduced in figs. 7 and 8. The general shape of these curves is that typical of any station supplying chiefly a power load. The important service rendered by the Sheaf Street works during the winter is shown by fig. 7, where also the output of the No. 4 Neepsend set is isolated from that of the remaining Neepsend plant. The average annual load factor of the whole undertaking was 17·14 per cent. in 1910-11, but the average load factor of the Neepsend station alone is now in the neighbourhood of 40 per cent. (See also Table I.)

Power factor rectifiers are at present used, but the importance of high power factor is much less in the new E.H.T. than in the old two-phase system, and, as the supply system grows, no particular trouble is anticipated in this direction.

Fig. 7 shows the power factors on the A and B phases at Sheaf Street of the two-phase trunk mains from Neepsend. The average day power factor of supply is 0·65—0·75 at Neepsend and 0·8 at Sheaf Street, rising to 0·90—0·95 at night.

The capital burden on the Sheffield undertaking has been particularly heavy in the past, and now averages £85 per KW. On the Neepsend station, however, the investment averages only £12 10s. per KW., so that the overall figure should show a considerable decrease in the near future (fig. 9). The very heavy investment of £27 per KW in mains is due to the scattered area supplied and to the fact that spare cable pipes are laid wherever necessary, to allow of future extensions without re-opening the streets.

The present capital sunk in the undertaking is close on £900,000, after deducting a liberal depreciation and obsolescence allowance (roughly, 10 per cent.), and including the loan of £61,000 raised last year for the Neepsend extensions. This loan forms a further instalment of the £250,000 provisionally approved by the Committee in July, 1908, and as the load supplied is increasing at the rate of 2,000-2,500 KW. per annum, there is no doubt that further extensions will soon be necessary.

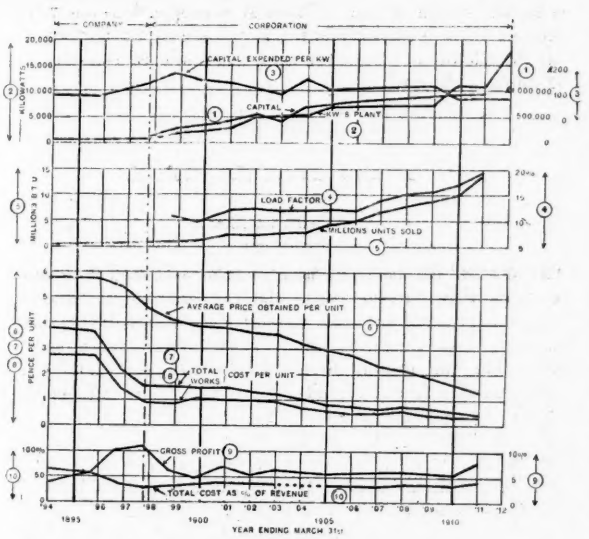


Fig. 9.—Financial Curves, &c., Sheffield Electricity Supply.

It will be seen from the curves in fig. 9, that consumers have consistently reaped the benefits of the forward policy of the undertaking. The rapid increase in sales and the exceptional provisions which have been made for future load developments should result in handsome profits in years to come. Already the tide has turned, and in 1911 the department obtained a surplus of £3,417, as compared with a deficit of £2,035 in the preceding year.

In concluding this review of a most important and enterprising undertaking, we must express our sincere thanks to Mr. S. E. Fedden, engineer and manager, and to Mr. H. A. Howie, deputy manager, for their most courteous and painstaking assistance.

OUTPUT OF MINERALS AND THE USE OF COAL-CUTTING MACHINERY IN 1911.

The annual reports of H.M. Inspectors of Mines for the eight districts into which the United Kingdom is divided for the year 1911 have recently been issued. These reports, as a rule, are full of interest not only to the mining profession but to other branches of engineering associated with mining machinery, and more especially electrical engineering which now enters so largely into mining work, as valuable lessons are to be learnt from the experience and investigations into the causes of accidents—unfortunately resulting too often in the loss of life—that are fully reported. We propose to deal with this phase of the reports in a future article, and at present confine ourselves to the output of minerals and the position of machine mining.

The total output of minerals for the year was 285,942,352 tons, being an increase of 7,332,403 tons over the year 1910, and of the total 271,878,244 tons are coal, and the remaining 14,064,108 tons other minerals chiefly ironstone and clays. The various outputs for the different districts, together with the increase or decrease compared with the year 1910, are shown in the following table :—

Output of Minerals.

	District.	Coal.	Other minerals.	Total.	Increase or decrease compared with the year 1910.
1.	Scotland ...	41,718,163	4,830,221	46,548,384	+ 342,832
2.	Newcastle ...	30,791,500	354,439	31,145,939	+2,183,440
3.	Durham ...	27,909,200	6,243,604	34,152,804	+1,670,747
4.	Yorkshire and Nth. Midland	66,976,877	553,562	67,530,439	+1,227,670
5.	Lancashire ...	11,020,695	148,499	11,169,194	+ 17,504
	Ireland ...	84,684	1,002	85,686	— 116
6.	Liverpool and Nth. Wales...	16,402,349	96,385	16,498,734	+ 233,526
7.	South Wales ...	50,200,727	156,049	50,356,776	+1,448,896
8.	Midland and Southern ...	26,774,049	1,680,347	28,454,396	+ 207,904
	Total ...	271,878,244	14,064,108	285,942,352	+7,332,403

In regard to machine coal-cutting, we find this to be steadily increasing year by year, though the same cannot be said of mechanical handling of the coal by means of conveyors. The total increase in the number of coal cutters over the number given in the year 1910 is 187, of which no less than 125 are electrically driven machines, and the total output due to machine mining was 18,667,346 tons, which is an increase of no less than 2,815,545 tons over the year 1910. In only one district is there any backward tendency, viz., that of Lancashire, where the number of machines decreased by 16, six of which were electrical, and the output of machine-cut coal was reduced by 36,144 tons.

The greatest development in machine mining took place in Scotland, the number of new machines installed being 95, and of these no less than 76 were electrically driven, and were responsible for an increase in the output of machine-won coal of 1,096,504 tons. On the other hand, as already mentioned, there was a reduction of 16 machines at work in the Lancashire district, six of which were electrical, and a reduction in the output of machine-mined coal of 36,144 tons. The Inspector expresses no opinion as to why this should be, and it is the more strange, in that, although a less number of coal cutters was at work, the number of conveyors increased from 37 to 79, or more than doubled.

In 1910, 11 electrically-driven coal cutters produced 96,812 tons, and 141 compressed air machines produced 405,549 tons, whilst in 1911 five electrical machines produced 43,684 tons, and 131 compressed air machines gave 424,833 tons, while in Ireland one electrical machine produced, in 1910, 4,000 tons, but, in 1911, only 1,700. It would seem, therefore, that the loss in output was due to the stopping of the six electrical machines, as it will be observed that the 131 compressed air machines produced more coal in 1911 than 141 did in 1910. Possibly a state of alarm was produced in this district after the terrible disaster at the Hulton Colliery at the end of 1909 regarding the use of electrical machines, as it may be remembered electricity was blamed — though absolutely without the slightest foundation—for causing the explosion.

In Scotland district there were 501 electrically-driven coal cutters, of which 336 were "disk," 149 "bar," and 16 "chain" type machines, which together produced 5,476,008 tons of coal, 234,186 tons of ironstone, and 3,197 tons of fireclay. There were 82 conveyors at work, which is 10 fewer than the previous year, and is "due to local conditions at the coal face, such as faults, condition of roof, &c., and the number, owing to these and other causes, is liable to fluctuate from year to year."

In the Newcastle district there were 46 electrical machines, of which 22 were "disk," 12 "bar," 11 "chain," and one a "percussive" type machine. The latter

is included in the electrically-driven machines, for although the cutters are operated by compressed air, a small electrically-driven compressor coupled direct to the cutter by a pair of flexible tubes, is an inherent part of the machine. Altogether the electric machines produced 513,149 tons of coal. There were 35 conveyors at work, or two less than in the previous year.

In Durham district 55 machines were at work, being an increase of seven, and included of 21 "disk," 20 "bar," 13 "chain," and one "percussive" type machine, and they produced 453,071 tons of coal collectively. There were 23 electrically driven, and 11 compressed air-driven conveyors at work against 12 and two respectively for the year 1910.

In Yorkshire, the late Mr. Pickering, whose sad death in connection with the recent disaster at the Cadeby mine will still be fresh in the minds of our readers, reported that "great progress was made in machine mining during the year." . . . . "The number of electrically-driven machines increased from 235 to 268, but the machines driven by compressed air decreased from 246 to 243," an excellent testimonial to the superiority of electricity as the motive power. There were at work 47 "bar," 64 "chain," 154 "disk," two percussive, and a "rotary heading" type machine, making a total of 268, and they produced 3,020,222 tons. There were also 45 conveyors at work, being an increase of seven from the previous year. Mr. Pickering says, "The value of face conveyors in thin seams is being gradually recognised." This view is supported by reference to the conditions in the Lancashire district already referred to, where, although the number of coal-cutters decreased, the conveyors rose from 37 to 79.

In Liverpool and North Wales we find a net increase of nine coal-cutting machines, but there is a decrease of one electrical machine and an increase of 10 compressed-air machines, as compared with the year 1910. But we find on referring back to the 1910 report there were 10 *fewer* during that year than in the year 1909, and the output from 129 machines in 1910 was 983,224 tons, as compared to 1,033,237 tons in 1909 for 139 machines. Hence, it is very satisfactory to note that in the year 1911 138 machines, or one machine less, produced 1,182,828 tons, or an increase of 149,591 tons over 1909. We find there were 6 "disk." 10 "bar" and one "chain" type machines, or a total of 17, and these produced 142,704 tons. Seven conveyors were at work, which was the same number as the previous year.

In South Wales, too, we have a reduction in the number of electrical machines at work of 8, but an increase of 14 compressed-air machines, yet while 51 electrical machines in 1910 only produced 318,015 tons, 43 machines gave an output of 322,657 tons in 1911. This is surely evidence of the steady advancement in efficiency of machine mining. The 43 machines at work consisted of 11 "disk," 28 "bar" and 4 "chain" types, and together produced 322,657 tons. There were, however, seven less conveyors at work, there being only 43, against 50 in the previous year.

In the Midland and Southern District we find 62 electrical coal-cutters at work; 28 "disk," 20 "bar," and 14 "chain" type machines, which produced 637,509 tons of coal and 83,526 tons of ironstone. There was only one face conveyor at work.

Analysing further the records, we find that the percussive type machine, which must be fixed in one position, yields approximately an output of 3,000 tons of mineral per annum; as, for instance, 488 percussive coal-cutters gave an output of 1,431,327 tons, while the other machines of long-wall type each yield approximately 11,000 tons per annum, as 1,521 machines, which include the disk, bar, chain and rotary header types gave an output of 16,775,802 tons. Unfortunately, the whole of the figures cannot be given, as Mr. Gerrard, in his report for the Manchester and and Ireland District, does not give the actual production of each type of machine, but—though he gives the number of the different machines at work—merely gives the total mineral produced. However, the figures are quite near enough to show the great superiority of the long-wall machines, more especially when it is remembered that these machines, electrically-driven, only take from 20 to 30 H.P., while a compressed-air percussive machine would require about the same power, seeing that each percussive machine taking air at 60 lb. per sq. in. would consume from 100 to 120 cb. ft. of air per minute. Even with the percussive machine there is an enormous reduction in power consumption when a small motor-driven compressor is directly attached to the machine, and we are surprised that this type of machine has not made further progress. From the figures, however, it would seem that the percussive type of machine is gradually giving way to the long-wall type, which is entirely due to the higher all-round efficiency of the latter.

Altogether there was a total of some 2,146 machines at work, of which only 545 were percussive machines, which, of course, must be driven by compressed air, and, moreover, cost only about £70 each, against the cost of £300 to £400 of the long-wall machine. Of the remainder, we find 998 were electrically-driven, thus leaving 603 compressed air long-wall machines. Thus there are over one-third more electrically-driven long-wall machines in our mines than those driven by compressed air, in spite of all attempts to depreciate it and the tremendous opposition brought against it by miners' leaders and a lot of silly people, who know very little of either electricity or mining. We think, in fact, the day is not far distant when compressed-air coal-cutters will be relics of the past.

SWITCHBOARD FIRES.

[COMMUNICATED.]

An electrical fire is at all times a most awkward occurrence to deal with, but it attains its greatest danger when it happens at a switchboard or the connections immediately adjacent to it. An arc on a cable, whether inside a station or outside, can usually be eventually stopped either by the operation of a fuse or circuit-breaker, or if these are not in a position to operate on the particular section involved, the cable will probably burn itself out; but when the trouble occurs on a switchboard at a generating or sub-station, it is a very difficult matter to get things right without the entire interruption of the supply. Fortunately, modern experience has to a large extent abolished the poor apologies for switchboards which formerly could be found, although even now improvements might be made with considerable advantage in many cases. Due regard has, however, been paid in the majority of cases to the abolition of inflammable materials such as wood work about the switchboard, and the spacing of the terminals and conductors sufficiently far apart to prevent to a large extent the danger of arcing on the board. Even in these days, however, the ordinary spanner has been known to start an arc leading to an interruption of supply and a hospital case, and with the temptation to reduce as far as possible the overall dimensions of a switchboard, caused by the possibility of getting large amounts of power into a small amount of space so far as the generating plant is concerned, by the use of turbo-driven machines, there is still the chance that the clearances allowed are not sufficient in some instances. It is not, however, proposed to enter into this question in this note.

What should be emphasised, however, is the necessity for proper space, ventilation and insulation at the back of the board, especially where high voltages are adopted. With the advent of three-phase systems and high-tension work generally, the dangerous portion, that is to say the high potential gear, is usually placed behind a screen formed by the switchboard panels, on the front of which are the operator's handles, and under ordinary circumstances the operator need not go behind the board. At the back of the board there will often be found a narrow gangway traversed by cables, or worse still, by leads from dividing boxes to the switchboard, these leads, be it noted, being of inflammable material, and the temperature of this chamber is frequently pretty high. Moreover, in some cases the designer appears to lack a knowledge of mechanical design. For example, cases have been known where heavy cables have been led up an outside wall passing into the switch chamber by means of ducts into which they were secured by wooden wedges or collars, the dividing boxes being placed, of course, inside the building. The weight and drag of the cable outside came directly on the wedges. Imagine what would happen

if the lead sheathing tore or the paper insulation became unduly compressed, or the wooden wedges shrank owing to the heat of the switch chamber. It is for reasons such as these that measures against switchboard fires should be taken by providing adequate ventilation. The electric fan is not a luxury in such cases. Again, some switchboard designers appear to forget that even in the most tightly-sealed chamber a certain amount of dust collects, and this dust has to be removed. The lot of the switchboard attendant who is told off on a high-tension job to go behind a cramped board with some form of feather duster or equally futile device, and attempt to get the dust off insulators carrying charged conductors, is not a happy one. Is it any wonder that in some instances such cleaning is more or less neglected; the result later on is a mysterious arc and a switchboard fire.

When the fire occurs it is, of course, useless to try the ordinary means of fire prevention: even fire brigades are beginning to understand this. Therefore prevention is better than cure. Supposing, however, that a fire does occur, for example, owing to excessive heat in the switch chamber volatilising the bitumen compound in the dividing box and allowing an arc to develop on the junction and spread along the cables, igniting anything inflammable. What is the best thing to be done? If the back of the switchboard is a constricted one, it is undoubtedly the best policy for the switchboard attendant to stay on the safest side of the switchboard, and no one can blame him if he takes care of his own life. A means which has been suggested is to have on the switchboard a box or bucket full of fine dry sand. If this is thrown on the arc and happens to strike it, and happens to stick, the heat of the arc will melt it, forming a film of insulating matter tending to interrupt the arc circuit. This, however, is analogous to the old method of putting out an ordinary fire by throwing small buckets of water on it. In other words, it is very good if it is successful. If the man who invented Cerebos salt cellars would come forward with an idea for projecting a well-directed stream of fine sand on to an arc he would probably confer a benefit upon the electrical industry, but at the present time such an invention still waits to make the fortune of the gentleman who brings it to a practical issue. Chemical extincteurs are, of course, of no use for this class of work, and therefore the thing which has usually to be done is to shut off the electric power from the arc, even at the cost of shutting down the station supply.

A word may be said in this connection with regard to secondary fires caused in the first instance by electric arcs. The heat of the arc is very liable to volatilise the constituents of bitumen and rubber insulation in the vicinity, with the result that this may catch fire. For this reason, a plan has been adopted on some switchboards of protecting all connections, which consist simply of bare copper arranged on porcelain insulators, by means of asbestos braiding, and this is very often of some considerable value. Even this, however, does not eliminate all trouble, and cases have been known where fires started by an electric arc have worked along the insulation of the cable consuming it, with the ultimate result that the fire has reached other portions of the structure. For this reason, the advantage of absolutely fireproof construction in the vicinity of the switchboard is obvious.

Another fact which tends towards spreading of a fire, should it be started by an electric arc, is the use of oil switches. These are undoubtedly of the utmost value in ordinary switching operations, and are now almost universally used for high-tension work. It is easily seen, however, that should the contents of such oil tanks catch fire there is every probability that it would be a most difficult matter to cope with the flames so produced. It is even more difficult when such switches are placed in a tunnel or chamber having a strong natural draught, as the rush of air caused by the fire is apt to fan the flames, and to make the trouble more difficult to deal with. For this reason the writer suggests that the type of switchboard which depends on natural draught for its ventilation at the back, and is closed at the ends by open-work grilles of expanded metal, should be modified by placing sheet-iron doors in place of the grilles, and using an electric fan to blow air through the chamber, which fan can be shut down if a fire develops inside, thus rendering the air stagnant, and assisting to quench the flames of a secondary fire.

A very good method which has been adopted on some switchboards is to enclose the incoming cables, and so far as possible, their connections even after leaving the dividing box in a sheet-iron trough or tray, which is then filled up with sand and a cover put on. This casing is then bound over with suitable clips, and the whole arrangement made fairly air-tight. The advantage of this is that should an arc develop, either in the cable, dividing box, or the leads, it will immediately melt some of the sand in its immediate vicinity, and this sand will form an insulating flux which will spread over the part affected by the arc, and tend to interrupt the circuit, thus quenching the arc. The disadvantage of this arrangement is that should it be necessary to inspect the cable or to make alterations, the casing is sometimes rather cumbersome to remove, and the sand is awkward to deal with, and such removal should not be attempted unless the portion of the switchboard in the vicinity is rendered dead. It will be seen, however, that the whole of the cable within the vicinity of the switchboard can be easily cased in in this way, and a means of protection against fire afforded at low cost, which goes far to eliminate fire risks. If, in addition to this, a wide earthed tray or trough filled with sand be placed all along the floor of the switchboard underneath the oil switches, it is evident that even should a switch tank catch fire and spill its contents, the burning oil will fall down into the sand and be soaked up by it, spreading only a short distance, and will burn itself out instead of allowing the stream of burning oil to spread itself over the floor of the switch chamber, and to drop off the switch gallery on to other apparatus.

The above notes do not cover this subject. They are only intended as indications of some of the means which can be adopted, and they are written with a view to promoting further discussion on a very important subject.

SOME NOTES ON CANVASSERS AND CANVASSING METHODS.

By "X. Y. Z."

A great deal has been written on the subject of Publicity in connection with the supply of electricity during the past few years—so much, in fact, that it might be considered that the subject has been well-nigh exhausted. The result of all this is that an efficient Publicity department is now considered a necessary section of every electricity supply undertaking. It is recognised that without this department the business of the undertaking will not increase at a satisfactory rate. The function of a Publicity department is two-fold; it has not only to demonstrate to the potential consumer that electricity can be advantageously used for a variety of purposes, but it has also to overcome the inertia of the individual, to persuade him to spend the necessary money and to make the requisite effort in order that he may avail himself of the advantages offered. This may appear to be so transparently true as to be hardly worth writing down, but, notwithstanding this, it is also likely to be overlooked in connection with Publicity work generally. In short, it is not sufficient that a person should know that electricity will do something or other for him—light his house, drive his shafting—but it is also requisite that there should be some influence or other to persuade him to allow it to do this. This is rendered particularly necessary in view of the fact that, from the point of view of the average person who reads the daily papers, and sees the gas company's canvasser as well as the electricity supply authorities' representative, there is not much to choose in point of cost between the two illuminants; indeed, there are not a few people who hold the exceedingly antiquated opinion that for ordinary inside lighting, at all events, gas is a good deal cheaper than electricity, having regard for quantity of light only. This persuasive force which is nearly always required, is, of course, only to

be supplied and directed by personal interview; no advertising, however taking, or letter, however clever, will do it. It is with the methods of canvassing and the qualifications of canvassers that the writer purposes dealing in this article.

In the first place, a canvasser must be something more than an ordinary commercial man. Unlike the usual traveller, he does not sell a particular article, but his function is to persuade the prospective consumer to take a continual supply of that commodity in which the canvasser is interested. Again, although the consumer buys each quarter, and pays for, a quantity of electrical energy, as such it is of no use to him; to be useful it must be converted into light, mechanical power or heat. These considerations suggest that a first-class canvasser should not only be a man of good address and general education, but that he should be endowed with a good and sound technical knowledge. He should be absolutely *au fait* with figures relating to gas-lighting, having at his finger tips the gas consumptions of all the up-to-date gas fittings, and also an approximate figure for their cost of maintenance. In addition, he should have thoroughly analysed any schemes put forward by the local gas authority, and have calculated the costs of gas, maintenance, and renewals. With this information, and in this way, he will acquire a familiarity with gas lighting which will be invaluable, as the prospective consumer will have more confidence in a man who knows exactly what gas can do. Such a canvasser will also be able to quickly calculate the exact advantage offered in connection with any special proposition put forward by the gas authorities, and he will not infrequently find, and of course explain to the consumer, that these propositions are actually not as advantageous as they at first sight appear. A canvasser who lacks this intimate knowledge of the details of gas lighting will be at a great disadvantage in interviewing a shrewd business man who has gone thoroughly into the question of the relative costs of both illuminants. In such a case as this it is essential that the canvasser should be quite familiar with both sides of the question.

A canvasser should, of course, be able to give an approximate estimate of the cost of an installation; this should be sufficiently near the actual figure at which the work can be done for it to be called an estimate, and not a rough guess very much too low. A canvasser will be called upon to advise the consumer respecting his installation, and to suggest schemes of illumination. This should be considered as part of the actual canvassing work, and not as a little "extra" afterwards thrown in free of charge. If the former view be taken, the canvasser will conscientiously act for the consumer, and his object will be the satisfaction of his client rather than the swelling of his commission. To advise on these lines the canvasser will have to keep in touch with all developments and improvements in electric lighting. With regard to the canvassing of prospective power users, the requirements of the ideal representative are far more extensive; it is safe to say that such a canvasser should be an engineer. Especially is this the case with the small power user. The displacing of a gas engine by an electric motor will nearly always involve some small alteration in the arrangement of the factory; the canvasser should be able to see clearly what alterations have to be made, and be able to explain these to the consumer, and give him a good idea of the cost. It frequently happens, for instance, that the installation of a motor involves the fixing of a short length of countershaft. The canvasser should be competent to see precisely how this can best be done, and to explain this to his client by a respectable sketch. The determination of the size of motor required is frequently by no means a simple matter. Little assistance can be obtained by an inspection of the gas engine if this should be of obsolete pattern. It will be requisite for the canvasser to have sufficient knowledge of the actual machinery used by the consumer to determine the power required. In many cases the owner of a factory has no idea as to the power his machines absorb, but he will know precisely their output with regard to the commodity in which he is interested. It is from this information that the canvasser should fix the size of motor to be installed, and to be able to do this accurately and certainly, he must have an extensive knowledge of the power required by all classes of machinery usually met with. To collect and obtain this information is no easy matter, but there is no question as to its utility. In this connection it will be of great service for the canvasser to visit the various trade exhibitions, where he will be able by a little diplomacy to obtain quite a quantity of information of a most valuable kind.

Canvassing methods will naturally vary with the disposition of the person being dealt with, and the canvasser must be a man possessing sufficient tact to determine clearly the attitude which it will be most advantageous to assume. In all cases, however, the prospective consumer should be regarded as a distinct personality, and not merely one of a huge collection of out-of-date beings who have yet to be instructed in the inestimable benefits of the use of electricity. In other words, it is not sufficient for the canvasser to be a kind of portable phonograph, who can reproduce glibly the information contained in circulars and smart advertisements. The use of the statement that electricity is x per cent. cheaper than gas—x being intended to vary with the apparent credulity of the man dealt with—is getting to be of less and less use. Information of this kind is imparted very much more cheaply, and almost as effectively, through the medium of circulars, and so forth. What is wanted is that a business proposition should be submitted to the prospective consumer, an offer to light his premises for so much per week. To treat with people in this way requires some amount of technical skill as well as sound business ability, but in these days, when most of the easy business has already been obtained, it is the only way to conduct successful canvassing.

The business to be obtained by canvassing, however skilful, depends necessarily on the resources of the canvasser in the way of special schemes and rates, as well as the prices of electricity and gas in the locality. These last are, presumably, governed by circumstances outside the scope of this article, but in the matter of special schemes, it is desirable to mention that these will very much assist the progress of the use of electricity. It is only right that those consumers, the nature of whose load will be beneficial to the supply authority, should share in this benefit, and it is with this object that the schemes for outside lighting are arranged. One of the great advantages of a good scheme of this kind is that it includes maintenance. The canvasser should know the proportion of the charge that is allocated for this item, and also the price per unit of current under such scheme. It is a further assistance to the canvasser, when installation work is undertaken by the supply authority, to be able to come to terms at once with regard to the price of the wiring and fittings. This should certainly be done by the canvasser, who should in ordinary circumstances do all business with his client. A further point that may be mentioned is the question of special rates to consumers who will guarantee a considerable minimum consumption. In all towns there will be premises which, lighted electrically, would take a sufficient supply to justify the consumer entering into an undertaking of this kind; and if this be the case, a special discount, in addition to that to which the consumer would be ordinarily entitled, could be arranged.

The subject of this article is too comprehensive to be effectively treated in a small space, and the aspects of the matter touched upon here have been few. The question of canvassing becomes increasingly important as time goes on, especially in those districts which are not capable of extending in habitable area. In any town there are, roughly speaking, three classes of premises: Those in which electricity will be used as soon as it is available, such as theatres, and the best class of residential property; those in which electricity will be used with a little persuasion and by the aid of a little circularising, such as better class shops; and, thirdly, those premises whose occupants who can only be obtained as consumers by skilful canvassing. The remainder, which is hopeless or impossible, need not be regarded; except perhaps to say this, that it is not so large as might be imagined. As publicity work has been a good deal to the front of late years, business of the second or easy class has almost disappeared, and that remaining is only to be obtained with difficulty and patience. People representing this third class receive the usual advertising statements with stony indifference, and are absolutely unaffected by the smartest publicity

literature, or the cleverest circular letter, even though it be typewritten and signed.

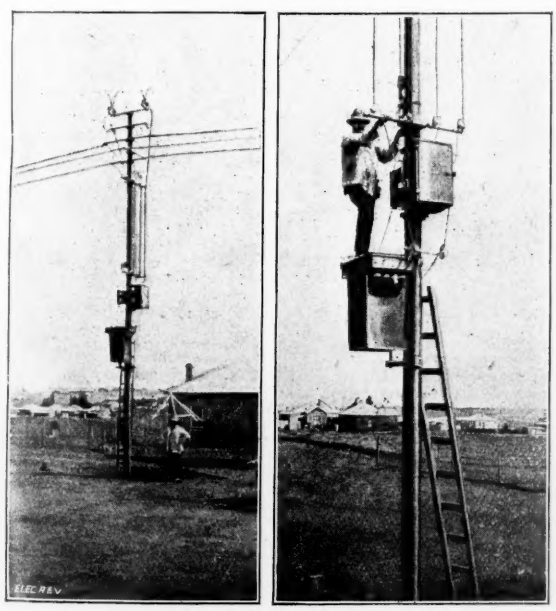
The canvassing of such people is really difficult, as not only has ignorance to be dispelled, and prejudice to be overcome, but a keen business instinct has to be met by one no less keen and, perhaps, a trifling amount more subtle.

ELECTRIC SUPPLY AT ROODEPORT, TRANSVAAL.

Since the Victoria Falls and Transvaal Power Co. got to work, the electricity supply of the various townships along the route of their mains has been undertaken by the company. It may be of interest to briefly describe the installation at Roodeport and adjacent townships which come under the Roodeport municipal control.

At the municipal boundary a mast switch is provided controlling the H.T. supply, which is three-phase at 3,300 volts, 50 cycles, and from here it is led direct to the main transformer house, centrally situated.

This transformer house contains two 50-KW. three-phase oil-cooled transformers, reducing the pressure to 400 volts between phases, 230 volts to neutral, and suitably controlled by a four-panel cellular pattern switchboard fitted with various meters, releases, oil switches, &c., on the H.T. side, and a three-panel board on the L.T. side, with the usual instruments: from this L.T. board the distributors are



Pole Line Construction, Roodeport, S.A.

taken overhead to all the consumers, as well as for the public lighting, which is controlled from this point. From here also a H.T. main is taken out overhead to supply the adjoining townships of Roodeport North, Hamburg and Maraisburg.

At each of these townships a mast pattern single-phase oil-cooled transformer is fixed for reducing the pressure to 230 volts, and is suitably protected by H.T. and L.T. fuses.

At Florida township a sub-station is provided, which is practically a replica of that in Roodeport, except that it is of a smaller capacity. The overhead mains consist of bare copper wire supported on steel tubular poles, the cross-arms being of galvanised tubing, and wherever it is possible to arrange it, the H. and L.T. wires are carried on the same poles, with a carefully earthed guard netting between them.

The public lighting consists of artistic brackets carrying 60 and 100-C.P. "Fortiter" metal lamps, and in view of the fact that the townships of this municipality lie some five miles apart, great appreciation has been expressed at the lighting on the lonely veldt roads.

Some 500 poles were used in the carrying of the mains, and over 2,000 insulators, and owing to the rocky nature of the ground, many of the holes had to be blasted to set the poles in.

The whole of the plant was put into operation at the end of January, and though at that time of the year lightning storms are most severe, the precautions taken to avoid disturbances have been very effective.

The H.T. lines are protected by horn and Wurtz arresters, and the L.T. lines by disk arresters provided with graphite resistance. A large number of consumers are already connected, and extensions are now being carried out by the municipality.

The consulting engineer was Mr. H. W. Clayden, the work being carried out by Mr. W. A. Hodge, the town engineer, who was responsible to the electrical contractors, the Union Electric Co., of Johannesburg, of which company Mr. H. W. Curling is manager.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

DENMARK.—The Danish Customs authorities have decided that electrical apparatus made up of different component parts, such as alternators, switches, fuse boxes, &c., which cannot from their nature and composition be referred to any other number of the tariff, will be included under Tariff No. 301 (unspecified goods), dutiable at the rate of 7½ per cent. *ad valorem*, provided the Customs examiners are in any doubt as to what can really be said to be the characteristic components of the article, *i.e.*, in all cases in which an immediate decision cannot be arrived at.

FIJI.—An ordinance revising the Customs tariff has recently been passed. The following are the chief items of interest to our readers which are affected by the revision, and the new rates replace those published some time ago in our columns:—

	Old rate.	New rate.
Boilers, steam, and component parts thereof, and boiler plates	Free	7½ % ad val.
Earthenware, chinaware, glass and glassware, not elsewhere specified	15 % ad val.	12½ „
Fuses	15 „	12½ „
Lamps and lampware	15 „	12½ „
Machinery and component parts thereof which the Governor in Council may from time to time specify, including agricultural, mining, electrical, paper-making, sawing, sugar-making, steam engines, oil engines, gas engines, hot-air engines, &c.	Free	7½ „
Rails, fishplates, switches, crossings, turntables, railway sleepers of iron or steel ...	Free	7½ „
Parts of iron and steel railway materials	Free	12½ „
All articles not specified in the tariff and not included in the free list	15 % ad val.	12½ „

CORSICA.—A law has recently been passed providing that foreign products on importation into Corsica shall in future be dutiable at the rates set out in the French tariff, with one or two exceptions that do not interest the electrical trade.

BOLIVIA.—The Board of Trade is informed that the duty of 2 per cent. recently imposed by law on articles which had previously been free of duty is assessed, so far as concerns articles subject to appraisement (*i.e.*, articles the value of which is not fixed by the official valuation tariff, but taken from the invoice), on the price in the country of origin, increased by 20 per cent. The following articles, however, are free of all duties:—Merchandise imported for the use of the different Government departments, under authorisation of the Minister of Finance: that which is imported for the personal use of members of foreign legations; importations for railroad undertakings in virtue of existing contracts; material destined for the Lighting and Power Co. of Cochabamba; merchandise freed expressly by international treaties; articles destined for hospitals and charitable institutions; materials for public works imported by the municipalities; articles which are imported for educational establishments; mining and agricultural machinery, and accessories for the same.

AUSTRALIA.—The Commonwealth Customs authorities have recently decided that binders or tapes of copper for electrical purposes, being copper strip merely cut to length, shall be admitted free of duty, whether of British or foreign origin.

NEW ZEALAND.—The Customs authorities have recently issued the following decisions as to the duties to be levied on certain electric appliances :—

Conduit piping junction boxes of iron, fitted with vulcanite disks (claimed as fittings for iron pipes)	20 % ad val.
Disks, vulcanite, bored, for conduit piping junction boxes	20 ,,
Electric garage lamps, being portable hand-lamps	10 ,,
Glass accumulator jars	20 ,,
Starting compensators, hand operated, for alternating-current motors	20 ,,
Electric eye magnets to remove metal from the eyes	Free

Note.—The duties quoted are in all cases those levied on goods of British origin, under the preferential tariff.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

18,908. "Electric flame arc lamps of the magazine type." H. E. ANGOLD. August 19th.

18,913. "Dynamo-electric machines." B. BROOKS and W. HOLT. (Addition to 26,880, 1910.) August 19th.

18,914. "Dynamo-electric machines." B. BROOKS and W. HOLT. August 19th.

18,922. "Mercury vapour lamp." W. R. WALLSEY. August 19th.

18,980. "Electric switches." A. PAGE. August 19th.

18,990. "Thermo-piles." J. MARSCHALL. August 19th. (Complete.)

19,000. "Means for converting a current." A. R. BULLOCK. August 19th. (Complete.)

19,088. "Ignition systems for starting explosion motors." R. MAGONDEAUX. (Convention date, March 20th, 1912, France.) August 20th. (Complete.)

19,053. "Construction of electric kettles." C. R. BELLING. August 20th.

19,054. "Construction of heating elements for electric radiators and the like." C. R. BELLING. August 20th.

19,064. "Electrically-heated cooking ovens and the like." H. J. PIPER and R. A. BRIDGWATER. August 20th.

19,069. "Igniting current-distributors for internal combustion motors." SIEMENS & HALSKE AKT. GES. (Convention date, August 26th, 1911, Germany.) August 20th. (Complete.)

19,073. "Electric snap switches." C. J. KLEIN. August 20th. (Complete.)

19,099. "Hand-regulated electric arc lamps or projectors." R. RIGBY. August 20th. (Complete.)

19,102. "Means for telephonic communication with mine cages." J. H. REINEKE. (Convention date, August 29th, 1011, Germany.) August 20th. (Complete.)

19,103. "Means for telephonic communication with mine cages." J. H. REINEKE. (Addition to 19,102/12.) August 20th. (Complete.)

19,113. "Apparatus for measuring the electric conductivity of liquids," M. COPLANS. August 21st.

19,118. "Electricity meters." S. H. HOLDEN and CHAMBERLAIN & HOOKHAM, LTD. August 21st.

19,134. "Controllers for electric motors and the like." ELECTRICAL CONTROL, LTD., and J. H. COWELL. August 21st.

19,164. "Automatic electric cut-out switches." R. WINTERHALDER. August 21st. (Complete.)

19,172. "Electric furnaces." G. MASSIP. (Convention date, August 22nd, 1911, Germany.) August 21st. (Complete.)

19,174. "Miners' electric lamps." O. OLDHAM. August 21st.

19,199. "Cinematograph gas or electric lamp and attachment." A. KENDRICK. August 22nd.

19,203. "Apparatus or appliances for electrically operating and controlling valves." A. BRYAN and L. F. MOUNTFORT. August 22nd.

19,213. "Enumeration of telephone calls." S. D. WILLIAMS. August 22nd.

19,249. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. (Automatic Electric Co., United States.) August 22nd. (Complete.)

19,250. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. (Automatic Electric Co., United States.) August 22nd. (Complete.)

19,251. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. (Automatic Electric Co., United States.) August 22nd. (Complete.)

19,252. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. (Automatic Electric Co., United States.) August 22nd. (Complete.)

19,253. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. (Automatic Electric Co., United States.) August 22nd. (Complete.)

19,254. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. (Automatic Electric Co., United States.) August 22nd. (Complete.)

19,255. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. (Automatic Electric Co., United States.) August 22nd. (Complete.)

19,257. "Electrical winding gear for clocks and the like." L. J. ARON, C. WERNER and X. L. ELECTRIC CO., LTD. (Addition to 9,154 of 1912.) August 22nd. (Complete.)

19,264. "Electric arc lamps." N. H. BALFOUR and A. B. HITCHIN. August 22nd.

19,267. "Electrically-heated blankets and other coverings and appliances." J. DE BERNARD and J. EBBSMITH (trading as Marie Earle). August 22nd. (Complete.)

19,287. "Electric furnaces." L. GONNET. (Convention date, March 15th, 1912, France.) August 22nd. (Complete.)

19,301. "Electric safety and regulating-current switches." E. M. BAILEY, W. TAYLOR and B. BAILEY. August 23rd.

19,310. "Electric lampholders." J. W. TOWNSEND. August 23rd.

19,318. "Self-contained portable electric lamps." S. STERN and BRITISH EVER-READY ELECTRICAL CO., LTD. August 23rd.

19,341. "Circuits for establishing a connection between subscribers connected to different telephone exchanges." SIEMENS BROS. & CO., LTD., and E. A. LAIDLAW. August 23rd. (Complete.)

19,345. "Means for lighting vehicles by electricity." S. L. PRICE. August 23rd.

19,405. "Series-parallel electric lighting or power circuits." A. P. LUNDBERG, G. C. LUNDBERG and P. A. LUNDBERG. August 24th.

19,425. "Feeding mechanism for the electrodes of electric arc lamps." F. STEINERT. (Divided application on 1,755 of 1912, January 22nd.) August 24th. (Complete.)

19,429. "Electrically-controlled clocks." N. FRIEDMANN and I. FRIEDMANN. August 24th. (Complete.)

19,432. "Electrically-operated driving systems." CROMPTON & Co., LTD., C. MACFARLANE and H. BURGE. August 24th.

19,448. "Electric arc lamps." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) August 24th.

19,451. "Switches for electric hand lamps." S. STERN and BRITISH EVER-READY ELECTRICAL CO., LTD. August 24th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

CONTROLLER AND REGULATING RESISTANCE FOR ELECTRIC MOTORS. W. W. French. 6,997. (Convention date, September 21st, 1911.)

MEANS FOR REGULATING ELECTRIC LAMP CIRCUITS. H. Leitner. 17,791. August 4th.

ELECTRICAL HEATING APPARATUS, PARTICULARLY VULCANISERS. W. H. Welch and Harvey, Frost & Co., Ltd. 17,810. August 4th.

REGISTERING DEVICE FOR TELEPHONE SYSTEMS. Western Electric Co., Ltd. (Western Electric Co.) 17,874. August 5th.

MAGNETO-ELECTRIC APPARATUS. W. Douglas. 17,982. August 8th.

WIRELESS TELEPHONY. H. G. Matthews. 18,284. (Cognate application, 25,718 of 1911.)

AUTOMATIC STARTERS FOR ELECTRIC MOTORS. M. B. Field. 18,611. August 17th.

IGNITION SYSTEMS FOR INTERNAL-COMBUSTION ENGINES. L. J. Flint. 18,699. August 19th.

ELECTRICAL APPLIANCE FOR TRANSMITTING MESSAGES, WITH PROVISION FOR TAKING A RECORD OF EACH MESSAGE AND NOTIFYING THE RECORD TO THE SENDER OF THE MESSAGE. D. S. Davies and C. H. Mason. 19,210. August 28th.

IGNITION PLUGS. H. G. Longford, W. W. Longford and W. A. Clark. 20,207. September 12th. (February 29th, 1912.)

ARC LAMPS. W. R. Ridings. 21,735. October 3rd.

CONTROLLERS FOR ELECTRIC MOTORS. W. B. Bennitt. 21,800. October 3rd.

VAPOUR ELECTRIC APPARATUS. P. C. Hewitt. 21,904. October 4th.

DISTRIBUTION OF ELECTRICAL ENERGY. P. V. Hunter and W. L. Shand. 22,624. October 18th.

ELECTROLYTIC APPARATUS. A. E. Knowles. 22,759. October 16th.

APPARATUS FOR ACTUATING CONDUIT COVERS AND COLLECTOR PLOUGHS OF ELECTRIC RAILWAYS. D. D. Samaia. 23,495. October 24th.

ELECTRIC LIGHTING AND HEATING OF RAILWAY OR OTHER VEHICLES. Pintsch's Patent Lighting Co. and C. H. Vidal. 24,552. November 4th.

AUTOMATIC TELEPHONE SYSTEMS. G. A. Betulander. 25,216. (November 16th, 1910.)

ELECTRIC HEATING APPLIANCES AND ELECTRODES FOR ELECTRO-MEDICAL AND OTHER PURPOSES. G. Jahr. 25,477. (November 15th, 1910.)

PROCESS FOR THE ELECTRICAL WELDING OF THE SEAMS OF TUBES. Ges. fur. Elektrotechnische Industrie. 26,440. (December 7th, 1910.)

1912.

ELECTRIC IGNITERS. J. Born. 8,327. April 6th. (April 7th, 1911.)

SPEED REGULATION OF ALTERNATING-CURRENT INDUCTION MOTORS. Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke Ges.) 9,134. April 18th.

ELECTROMAGNETICALLY-CONTROLLED GAS VALVES. Compagnie du Gaz Electrique. 14,466. June 20th. (April 17th.)

TELEPHONE SYSTEMS. Derriman. (Automatic Electric Co.) 15,135. (Divided application on 15,133 of 1911. June 28th.) June 28th.

INCANDESCENT ELECTRIC LAMPS. R. H. Singley. 3,348. February 9th.

ELECTRO-MECHANICAL DEVICE FOR RECORDING AND REPRODUCING SOUNDS AND OPTICAL IMPRESSIONS. M. E. Thomas. 4,185. February 19th.

CONTROL OF VARIABLE-SPEED DYNAMOS, SUCH AS THOSE EMPLOYED FOR TRAIN LIGHTING. Electric and Ordnance Accessories Co., J. Etchells and E. W. Price. 6,269. (Addition to 6,611 of 1911.) March 13th.

ELECTRIC INCANDESCENT LAMPS. A. C. Hyde. 6,487. March 15th.

FREQUENCY INDICATOR FOR ALTERNATING CURRENTS. W. P. Thompson. (Ges. fur Drahtlose Telegraphie.) 7,658. March 29th.

CONSTRUCTION OF ELECTRIC RESISTANCE DEVICES. G. Cooper. (Boelling.) 9,861. April 25th.

SUBMARINE CABLES ARTIFICIALLY LOADED WITH SELF-INDUCTION. Siemens and Halske Akt.-Ges. 10,053. (April 28th, 1911.)

PROCESS FOR THE ELECTRO-DEPOSITION OF ZINC. E. Ballegeer. 11,271. May 11th.

DRIVING ARRANGEMENTS OF IGNITION MAGNETOS. W. A. Hill. 12,193. May 22nd.

ARC LAMPS. Harle & Cie. 13,358. (June 15th, 1911.)

ELECTROLYTIC APPARATUS. A. E. Knowles. 15,103. (Divided application on 22,759 of 1911. October 16th.)

Barking Electricity Supply.—The income of the electricity undertaking for the year ended March 31st last amounted to £13,185, as compared with an expenditure of £9,480, which leaves a gross trading profit for the year of £3,704. The units sold to the tramways undertaking amounted to 319,500, which, at 1½d. per unit, brought in a revenue of £1,997. The total quantity of units generated during the year amounted to 1,943,307, and of this amount 1,569,164 were sold (960,793 for private lighting and power, 288,871 for public lighting and 319,500 for traction); 269,642 were used on works, and 104,501 used in distribution. The maximum demand on the feeders during the year amounted to 680 KW.; £6,218 of the total expenditure for the year went towards generation expenses, while £1,208 represented the cost of distribution. The total expenditure on capital account during the year amounted to £466, while the expenditure since the commencement of the undertaking amounts to £63,055.